EPA-Approved

SANTA FE RIVER *E. COLI*
TOTAL MAXIMUM DAILY LOADS (TMDLS)

[CIENEGA CREEK TO NICHOLS RESERVOIR]

May 3, 2017

Prepared by

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For additional information please visit:

https://www.env.nm.gov/swqb/

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Cover Photo:
Santa Fe River immediately below City of Santa Fe WWTP effluent channel during municipal reservoir spring release (04/29/10)

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LIST OF ABBREVIATIONS

4Q3	4-Day, 3-year low-flow frequency
AU	Assessment Unit
BLM	Bureau of Land Management
BMPs	Best management practices
CFR	Code of Federal Regulations
cfs	Cubic feet per second
cfu	Colony forming units
CGP	Construction general storm water permit
CoolWAL	Cool Water Aquatic Life
CWA	Clean Water Act
CWAL	Cold Water Aquatic Life
HUC	Hydrologic unit code
IR	Clean Water Act §303(d)/ §305(b) Integrated Report and List
km^2	Square kilometers
LA	Load allocation
lbs/day	Pounds per day
mgd	Million gallons per day
mg/L	Milligrams per Liter
mi^2	Square miles
mL	Milliliters
MOS	Margin of safety
MOU	Memorandum of Understanding
MS4	Municipal separate storm sewer system
MSGP	Multi-sector general storm water permit
NM	New Mexico
NMAC	New Mexico Administrative Code
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
QAPP	Quality Assurance Project Plan
RFP	Request for proposal
sMS4	small Municipal separate storm sewer system
SQUID	Surface water QUality Information Database
SWPPP	Storm water pollution prevention plan
SWQB	Surface Water Quality Bureau
TMDL	Total Maximum Daily Load
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WLA	Waste load allocation
WQCC	Water Quality Control Commission
WQS	Water quality standards (NMAC 20.6.4 as amended through June 5, 2013)
WBP	Watershed-based plan
WQX	Water Quality Exchange USEPA database
WWTP	Wastewater treatment plant

EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act, a.k.a., Clean Water Act (CWA), 33 U.S.C. §1313[1], requires states to develop Total Maximum Daily Load (TMDL) management plans for water bodies determined to be water quality limited. A TMDL is defined as "*a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standard including consideration of existing pollutant loads and reasonably foreseeable increases in pollutant loads*" (USEPA 1999). A TMDL defines the amount of a pollutant a water body can assimilate without violating a state's water quality standards and allocates that load capacity to known point sources and nonpoint sources. It further identifies potential methods, actions, or limitations that could be implemented to achieve water quality standards. TMDLs are defined in 40 Code of Federal Regulations Part 130 as the sum of the individual Waste Load Allocations (WLA) for point sources and Load Allocations (LA) for nonpoint source and background conditions; see 40 C.F.R. §130.2(i)[2]. TMDLs also include a Margin of Safety (MOS), a required component that acknowledges and counteracts uncertainty.

The New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB) Monitoring, Assessment, and Standards Section (MASS) conducted a water quality survey of Middle Rio Grande tributaries, including the Santa Fe River, in 2014. Additional data have been collected in the Santa Fe River during special studies 2012-2016. This TMDL document addresses assessed *E. coli* impairments as summarized in Tables ES-1 through ES-3 below. Assessment of data collected May 1, 2012, to August 5, 2016, identified other water quality impairments which are not addressed in this document. Additional information regarding these impairments can be reviewed in the current Clean Water Act §303(d)/ §305(b) Integrated Report and List (IR)[3]. The Surface Water Quality Bureau intends to prepare additional TMDL documents to cover other confirmed impairments in the Santa Fe River.

SWQB's MASS will collect water quality data during the next rotational cycle. The next scheduled monitoring date for the Middle Rio Grande and tributaries is 2023, at which time TMDL targets will be re-examined and potentially revised as this document is considered to be an evolving management plan. In the event that new data indicate that the targets used in this analysis are not appropriate and/or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reach will be moved to the appropriate category in the IR.

[1] http://www.epw.senate.gov/water.pdf
[2] http://www.gpo.gov/fdsys/pkg/CFR-2002-title40-vol18/pdf/CFR-2002-title40-vol18-part130.pdf
[3] https://www.env.nm.gov/swqb/303d-305b/

Table ES-1. *E. coli* TMDL Summary for Santa Fe River (Cienega Creek to Santa Fe WWTP)

New Mexico Standards Segment	20.6.4.113
Waterbody Identifier	NM-2110_00
Stream Reach Length	6.9 miles
Pollutant of Concern	*E. coli*
Impaired Designated Use	Primary Contact
Geographic Location	Rio Grande – Santa Fe USGS Hydrologic Unit Code 13020201
Size of Watershed	114 mi^2
Land Use/Cover	forest, urban or built up, rangeland, agricultural, barren land, tundra
Probable Pollutant Sources	Agriculture, Flow Alteration, Municipal Point Source Discharges, On-Site Treatment Systems (Septic), Urban Runoff/Storm Sewers, Wastes from Pets, Waterfowl, Wildlife other than Waterfowl
Land Management	private, US Forest Service, BLM, state
Priority Ranking	High
IR Category	5/5A

TMDL for *E. coli*

	Low Flow Condition (cfu/day)	**High Flow Condition (cfu/day)**
Wasteload Allocation (WLA)		
Santa Fe WWTP (NM0022292) Current	3.1×10^{10}	3.1×10^{10}
Santa Fe WWTP (NM0022292) Future	3.1×10^{10}	3.1×10^{10}
Santa Fe sMS4 (NMR04000)	-- [(a)]	1.6×10^{10}
Load Allocation (LA)	3.7×10^{9}	3.0×10^{10}
Margin of Safety (MOS 10%)	7.3×10^{9}	1.2×10^{10}
***E. coli* TMDL (cfu/day)**	**7.3×10^{10}**	**1.2×10^{11}**

Notes: cfu = colony forming units

[(a)] sMS4 allocations are not applicable during "Low Flow" conditions

Table ES-2. *E. coli* TMDL Summary for Santa Fe River (Santa Fe WWTP to Guadalupe Street)

New Mexico Standards Segment	20.6.4.136
Waterbody Identifier	NM-9000.A_061
Stream Reach Length	10 miles
Pollutant of Concern	*E. coli*
Impaired Designated Use	Primary Contact
Geographic Location	Rio Grande – Santa Fe USGS Hydrologic Unit Code 13020201
Size of Watershed	50.7 mi^2
Land Use/Cover	forest, urban or built up, rangeland, agricultural, tundra
Probable Pollutant Sources	Flow Alteration, Drought-Related Impacts, Inappropriate Waste Disposal, Irrigation Return Flow, On-Site Treatment Systems (Septic), Urban Runoff/Storm Sewers, Wastes from Pets, Wildlife other than Waterfowl
Land Management	US Forest Service, private, BLM, state
Priority Ranking	High
IR Category	5/5A

TMDL for *E. coli*

	Low Flow Condition (cfu/day)	**Mid-Range Flow Condition (cfu/day)**	**High Flow Condition (cfu/day)**
Wasteload Allocation (WLA)			
Santa Fe sMS4 (NMR04000)	-- [(a)]	-- [(a)]	2.2×10^{10}
Load Allocation (LA)	2.6×10^{9}	1.6×10^{10}	7.7×10^{9}
Margin of Safety (MOS 10%)	2.9×10^{8}	1.8×10^{9}	3.3×10^{9}
***E. coli* TMDL (cfu/day)**	**2.9×10^{9}**	**1.8×10^{10}**	**3.3×10^{10}**

Notes: cfu = colony forming units

[(a)] sMS4 allocations are not applicable during "Low Flow" conditions

Table ES-3. *E. coli* TMDL Summary for Santa Fe River (Guadalupe St to Nichols Reservoir)

New Mexico Standards Segment	20.6.4.137
Waterbody Identifier	NM-9000.A_062
Stream Reach Length	10 miles
Pollutant of Concern	*E. coli*
Impaired Designated Use	Primary Contact
Geographic Location	Rio Grande – Santa Fe USGS Hydrologic Unit Code 13020201
Size of Watershed	33.8 mi^2
Land Use/Cover	forest, urban or built up, rangeland, tundra
Probable Pollutant Sources	Flow Alteration, Dams/Diversion, Drought-Related Impacts, Inappropriate Waste Disposal, Low Water Crossing, On-Site Treatment Systems (Septic), Urban Runoff/Storm Sewers, Wastes from Pets, Wildlife other than Waterfowl
Land Management	US Forest Service, private
Priority Ranking	High
IR Category	5/5A

TMDL for *E. coli*

	Low Flow Condition (cfu/day)	**High Flow Condition (cfu/day)**
Wasteload Allocation (WLA)		
Santa Fe sMS4 (NMR04000)	-- [(a)]	2.4×10^9
Load Allocation (LA)	1.7×10^9	1.4×10^{10}
Margin of Safety (MOS 10%)	1.9×10^8	1.8×10^9
***E. coli* TMDL (cfu/day)**	**1.9×10^9**	**1.8×10^{10}**

Notes: cfu = colony forming units

[(a)] sMS4 allocations are not applicable during "Low Flow" conditions

1.0 BACKGROUND

1.1 Description and Land Ownership

The Santa Fe River originates in the Sangre de Cristo mountains in Santa Fe County, and flows generally southwest through the city of Santa Fe, then down La Bajada hill towards Cochiti Reservoir on the Rio Grande (Figure 1.1).

Figure 1.1 General location of the Santa Fe River watershed in New Mexico

The mouth of the Santa Fe River is split -- a constructed channel delivers occasional flow directly to Cochiti Reservoir, while the original Santa Fe River channel merges with the Rio Grande in a wetland below Cochiti Dam, created largely by seepage beneath the dam (Grant 2002). Cienega Creek is the only perennial tributary in the watershed. The entire Santa Fe River watershed ranges from 1,676 to 3,530 meters (5,500 to 11,580 feet) in elevation, and covers approximately 389 square miles. Land ownership and geology are presented in Figures 1.2, and 1.3, respectively. Land use/cover as well as the Santa Fe urban area are provided in Figure 1.4.

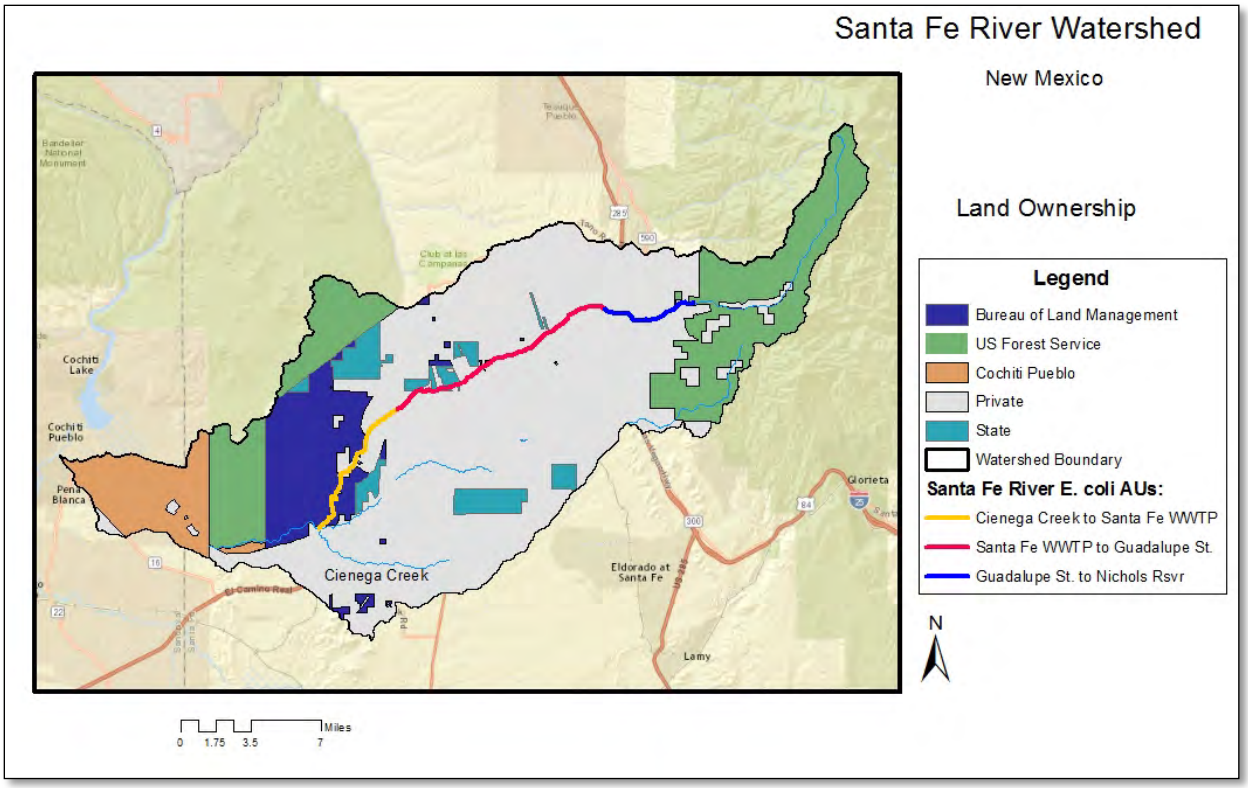

Figure 1.2 Land ownership in the Santa Fe River watershed

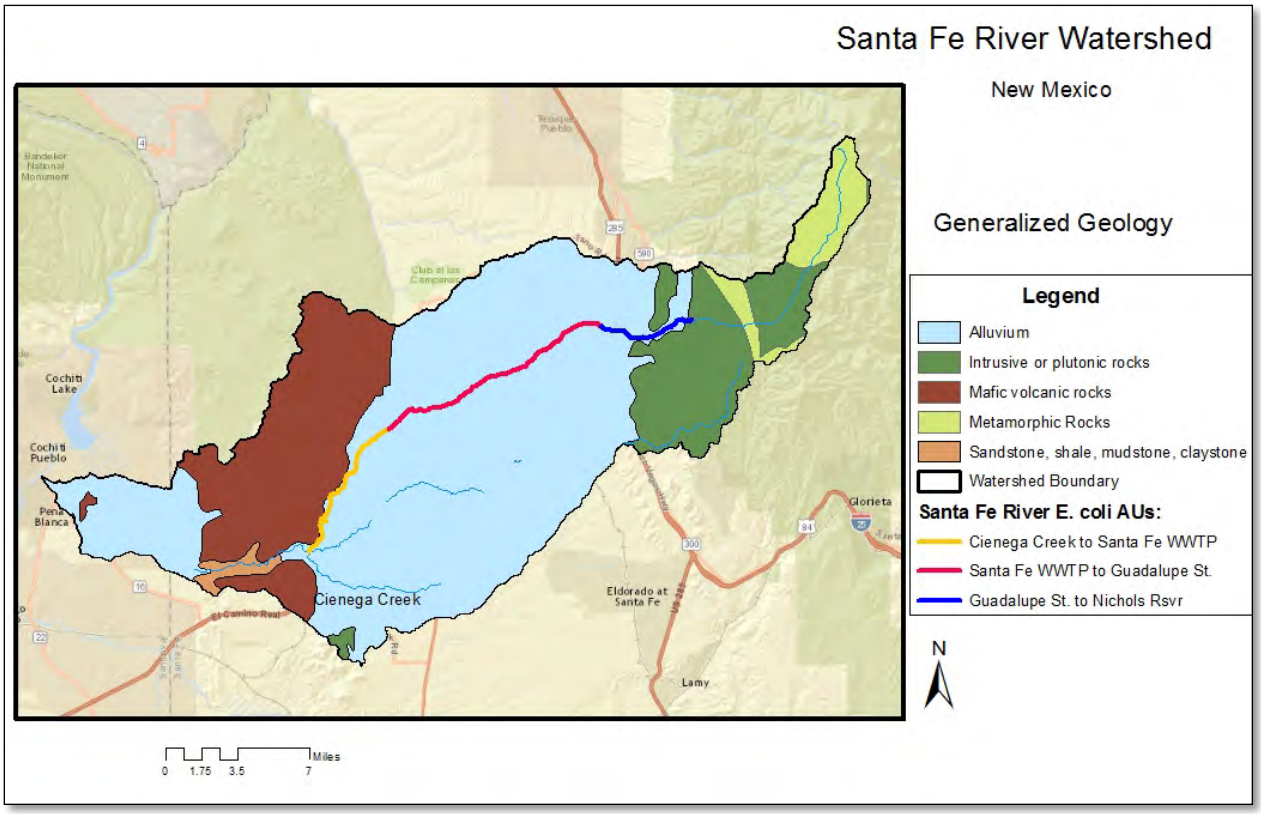

Figure 1.3 Generalized geology of the Santa Fe River watershed

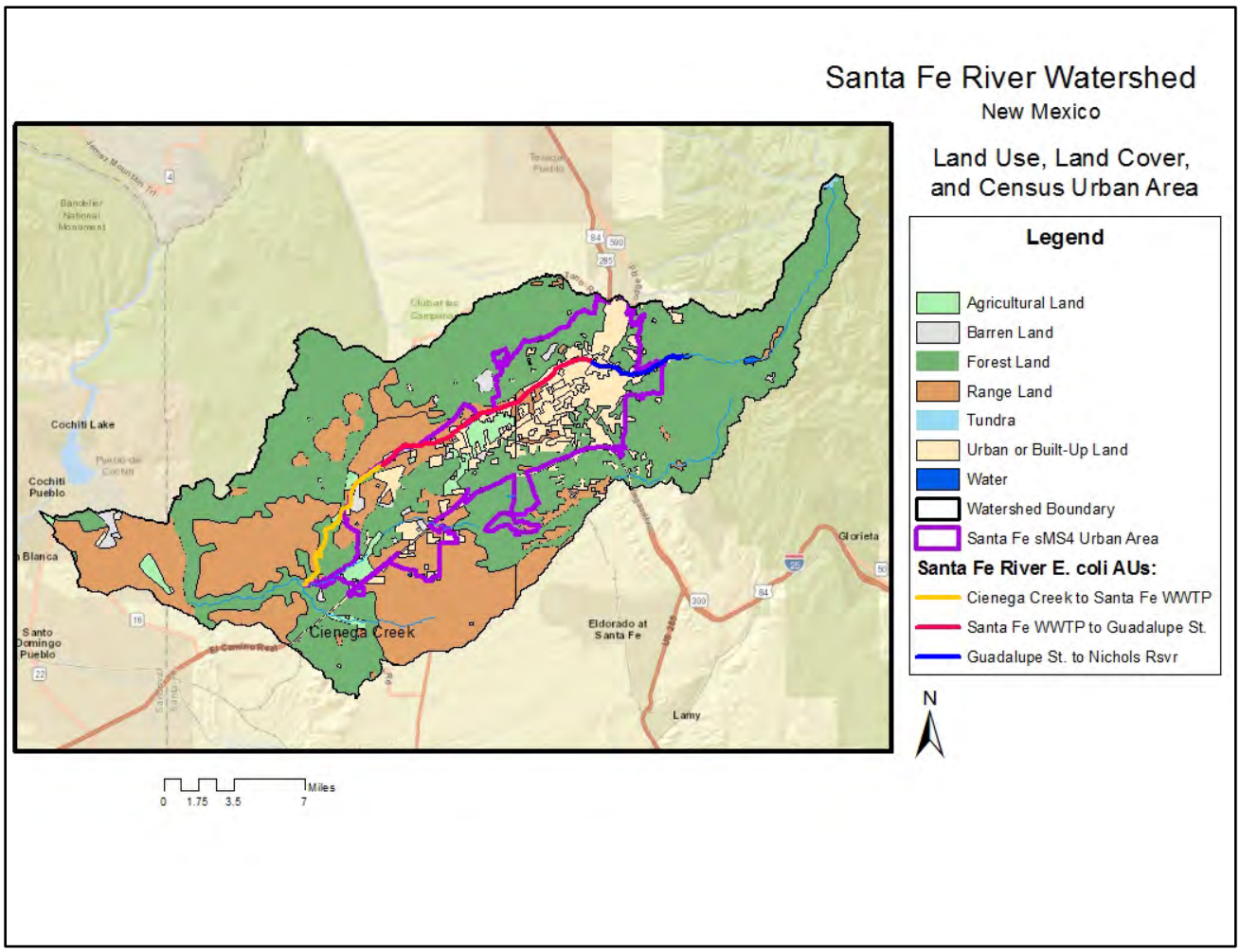

Figure 1.4 Land use and cover in the Santa Fe River watershed

1.2 Applicable Water Quality Standards

New Mexico's *Standards for Interstate and Intrastate Surface Waters* (20.6.4 NMAC) establish surface water quality standards (WQS) that consist of designated uses of surface waters of the State, the water quality criteria necessary to protect the uses, and an antidegradation policy. The WQS for all assessment units in this document are set forth in the following sections of 20.6.4 NMAC as amended through June 5, 2013 (NMAC 2013).

20.6.4.113 RIO GRANDE BASIN - The Santa Fe river and perennial reaches of its tributaries from the Cochiti pueblo boundary upstream to the outfall of the Santa Fe wastewater treatment facility.

A. Designated uses: irrigation, livestock watering, wildlife habitat, primary contact and coolwater aquatic life.

B. **Criteria:** The use-specific criteria in 20.6.4.900 NMAC are applicable to the designated uses, except that the following segment-specific criterion applies: temperature 30°C (86°F) or less.

20.6.4.136 RIO GRANDE BASIN - The Santa Fe river from the outfall of the Santa Fe wastewater treatment facility to Guadalupe street.

A. **Designated uses:** limited aquatic life, wildlife habitat, primary contact, livestock watering, and irrigation.

B. **Criteria:** the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses.

20.6.4.137 RIO GRANDE BASIN - The Santa Fe river from Guadalupe street to Nichols reservoir.

A. **Designated uses:** coolwater aquatic life, wildlife habitat, primary contact, livestock watering, and irrigation.

B. **Criteria:** the use-specific numeric criteria set forth in 20.6.4.900 NMAC are applicable to the designated uses.

20.6.4.900(D) NMAC details the specific *E. coli* water quality criteria applicable to the Santa Fe River:

> **Primary Contact:** the monthly geometric mean of *E. coli* bacteria of 126 cfu/100mL and single sample of 410 cfu/100 mL within the pH range of 6.0 to 9.0 apply to this use.

Bacteria standards are expressed as colony forming units (cfu) per unit volume, typically expressed as cfu per 100 mL (cfu/100mL). The presence of *E. coli* bacteria is an indicator of the possible presence of other pathogens that may limit beneficial uses and present human health concerns.

1.3 Antidegradation and TMDLs

New Mexico's antidegradation policy, which is based on the requirements of 40 CFR Part 131.12, describes how waters are to be protected from degradation (20.6.4.8(A) NMAC). At a minimum, the policy mandates that "the level of water quality necessary to protect the existing uses shall be maintained and protected in all surface waters of the state." Furthermore, the policy's requirements must be met whether or not a segment is impaired. TMDLs are consistent with the policy because implementation of a TMDL restores water quality so that existing uses are protected and water quality criteria are achieved.

The *Antidegradation Policy Implementation Procedure* establishes the process for implementing the antidegradation policy (Appendix A of NMED/SWQB 2011). However, specific requirements in the *Antidegradation Policy Implementation Procedure* do not apply to the Commission's establishment of TMDLs because these types of water quality-related actions already are subject to extensive requirements for review and public participation, as well as various limitations on degradation imposed by state and federal law (NMED/SWQB 2011).

1.4 Water Quality Data

Surface water quality samples related to this document were collected during the New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB) 2014 Middle Rio Grande and Tributaries study (NMED/SWQB 2015a), as well as during special SWQB studies from 2012-2016. See Figure 1.5 and Table 1.1 for stations relevant to this TMDL document. All sampling and assessment techniques used during the 2014 intensive and 2012-2016 additional data SWQB surveys are detailed in SWQB's *Quality Assurance Project Plan* (QAPP) (NMED/SWQB 2016a), *Standard Operating Procedures* (NMED/SWQB 2016b), and assessment protocols (NMED/SWQB 2015b). Data results are housed in SWQB's provisional water quality database (SQUID) and uploaded to USEPA's Water Quality Exchange (WQX) database. *E. coli* data relevant to this TMDL document are provided in Appendix A.

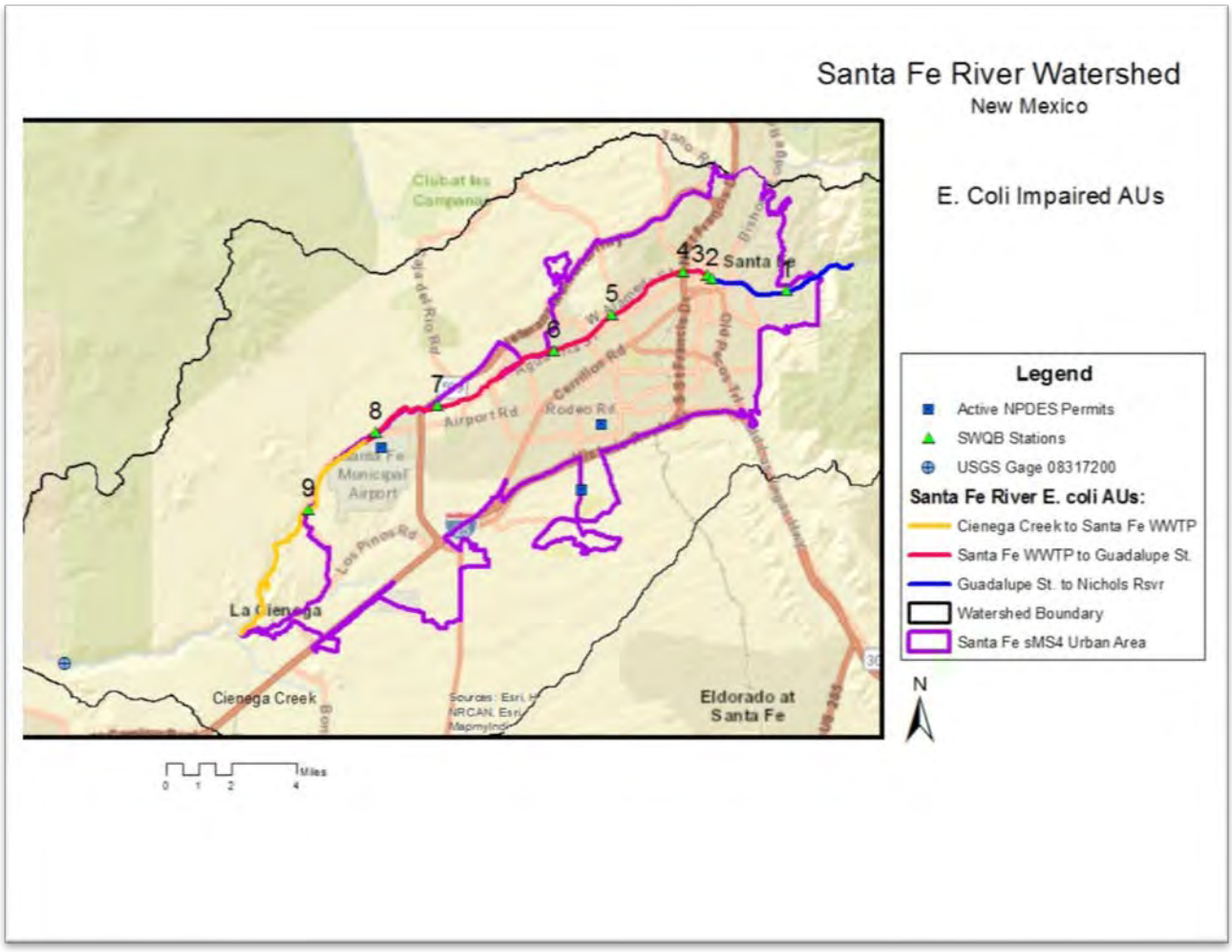

Figure 1.5 Santa Fe River assessment units and *E. coli* stations, 2012-2016

Table 1.1 SWQB 2012-2016 Santa Fe River watershed *E. coli* sampling stations

Map #	Station ID	SWQB Station Name/Location	Assessment Unit
1	30SantaF052.4	Santa Fe River below Cerro Gordo RD	Santa Fe River (Guadalupe St to Nichols Rsvr)
2	30SantaF050.5	Santa Fe River ~75m upstream of Sandoval St	Santa Fe River (Guadalupe St to Nichols Rsvr)
3	30SantaF050.3	Santa Fe River 5 meters upstream of Guadalupe St	Santa Fe River (Guadalupe St to Nichols Rsvr)
4	30SantaF047.9	Santa Fe River below St Francis Dr.	Santa Fe River (Santa Fe WWTP to Guadalupe St)
5	30SantaF044.5	Santa Fe River below Frenchies Field	Santa Fe River (Santa Fe WWTP to Guadalupe St)
6	30SantaF041.2	Santa Fe River at County Road 68A (San Isidro Crossing)	Santa Fe River (Santa Fe WWTP to Guadalupe St)
7	30SantaF035.9	Santa Fe River above Hwy 599	Santa Fe River (Santa Fe WWTP to Guadalupe St)
8	30SantaF032.9	Santa Fe River immediately upstream of WWTP effluent channel	Santa Fe River (Santa Fe WWTP to Guadalupe St)
9	30SantaF028.4	Santa Fe River above County Road 56 d/s of river preserve	Santa Fe River (Cienega Creek to Santa Fe WWTP)

1.5 Data Assessment

Assessment of available 2012-2016 water quality data in the Santa Fe River watershed identified exceedences of the New Mexico water quality standards for *E. coli* bacteria in three Santa Fe River assessment units (AUs). Samples were assessed by comparing the *E. coli* grab sample results to the single sample criterion of 410 cfu/100 mL. Exceedence ratios are presented in Table 1.2.

Table 1.2 *E. coli* exceedences, 2012- 2016

Assessment Unit	Criterion (single sample)	Number of Exceedences	Number of Samples
Santa Fe River (Cienega Creek to Santa Fe WWTP)	410 cfu/100mL	3	9
Santa Fe River (Santa Fe WWTP to Guadalupe St)	410 cfu/100mL	8	18
Santa Fe River (Guadalupe St to Nichols Rsvr)	410 cfu/100mL	4	24

As a result, these assessment units are listed on New Mexico's CWA §303(d)/ §305(b) Integrated Report and List (IR) as impaired for *E. coli* (NMED/SWQB 2016c).

2.0 BACTERIA (*E. COLI)* TMDL

2.1 Numeric Water Quality Target

The applicable *E. coli* geometric monthly mean criterion value (126 cfu/100 mL) has been selected to calculate the allowable stream daily loads for *E. coli* impaired assessment units because it is the most conservative value. In addition, use of this lower value in TMDL calculations provides an implicit Margin of Safety (MOS). Furthermore, if the higher single sample criterion were used and achieved as a target, the geometric mean criterion at any given time might not be achieved whereas it would always be achieved if all single sample measurements used to calculate the measured geometric mean were all below the geometric mean value.

2.2 Critical Stream Flow

The Clean Water Act (CWA) requires that TMDLs take into account critical conditions for stream flow, loading, and water quality parameters as part of the analysis of loading capacity. The critical condition is defined as the set of environmental conditions that, if implemented controls were designed to protect, will ensure attainment of objectives for all other conditions. Therefore, TMDLs are calculated at a specific critical stream flow. For example, the critical condition for control of a continuous point source discharge is usually a low flow condition. Point source pollution controls designed to meet water quality standards for low flow conditions can often ensure compliance with standards for all other conditions. The critical condition for wet weather-driven sources may be a particular rainfall event, resulting in high or storm flow conditions associated with that event. Bacteria sources typically arise from a mixture of continuous and wet weather-driven sources. Accordingly, bacteria concentrations in surface water can and often do vary as a function of flow.

The hydrology of the Santa Fe River watershed is very complex due to two on-line municipal reservoirs above town, acequia deliveries and returns, seepage and evaporative losses through town, and the City of Santa Fe Paseo Real Waste Water Treatment Plant (WWTP) discharging into an otherwise ephemeral reach. Determination of the most representative critical flow is further complicated by the current lack of continuous stream gages operating for the same period of record within the impaired reaches.

A stakeholder desire to have a “living river” through town prompted the development of a series of publications related to the hydrology of the Santa Fe River (Lewis and Borchert 2009a, 2009b), and ultimately resulted in the Santa Fe Living River Ordinance which allows the city to put up to 1,000 acre-feet of water back into the Santa Fe River each year (Santa Fe 2012). The city of Santa Fe prepared these documents to synthesize available hydrologic data in the Santa Fe River watershed, specifically with respect to available water yield in order to propose various target release scenarios in the living river ordinance. These reports collated available data at the time from Santa Fe River stream gages that were in operation from approximately 2000 – 2010 (Figure 2.1). Although not in operation during the SWQB *E. coli* sampling time period (2012 – 2016), the Santa Fe River “Ricardo Road” and “Above St. Francis” gages discussed in these publications provide data and documentation regarding storm flow conditions in the non-perennial reaches of the Santa Fe River through town.

The city of Santa Fe continues to operate the "Below Nichols Reservoir" gage which was also examined along with SWQB flow observations to determine potential critical flows in the Santa Fe River. There is one active USGS stream gage approximately six miles downstream of the confluence with La Cienega Creek, below La Bajada Hill near the Cochiti Pueblo boundary (USGS gage 08317200).

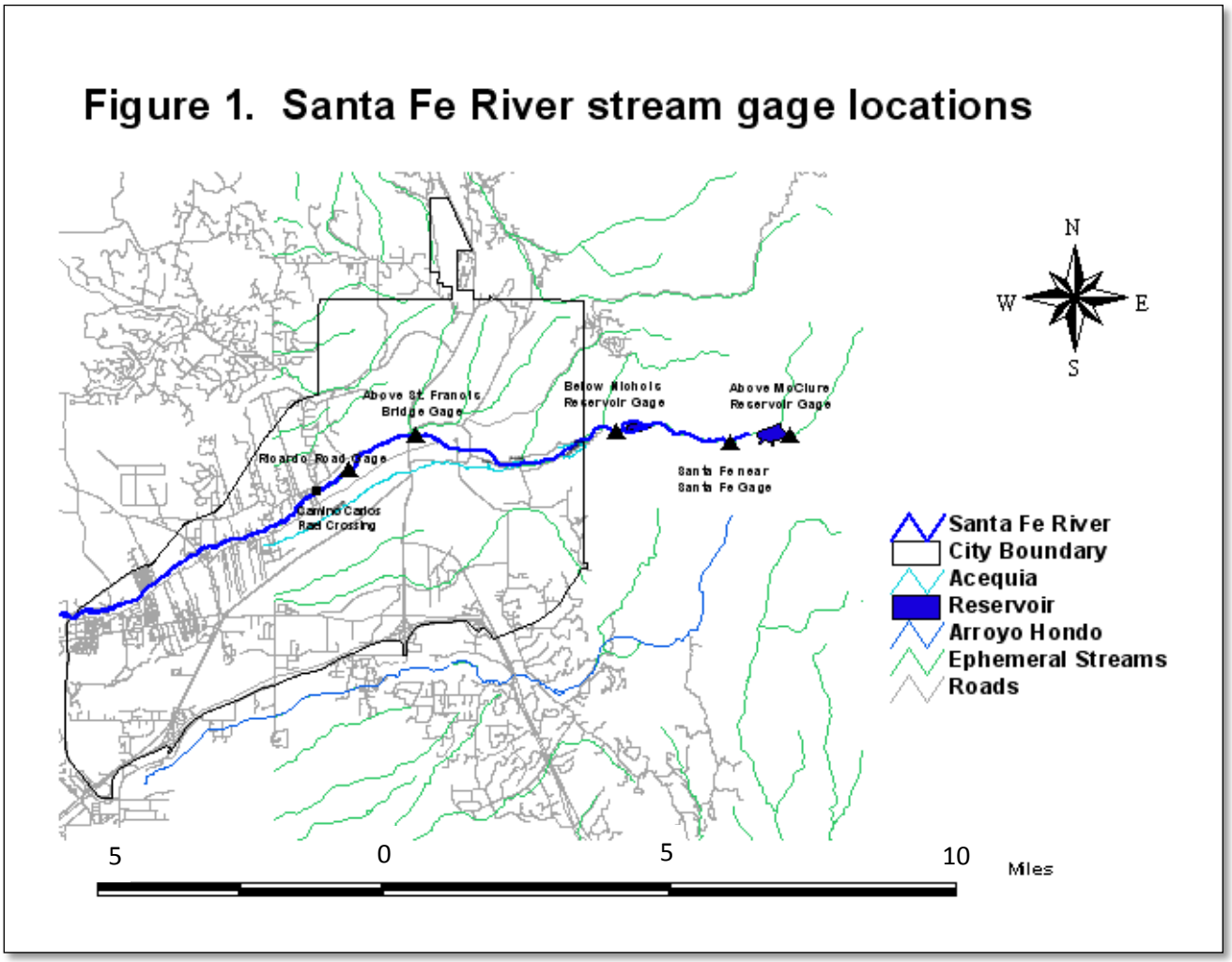

Figure 2.1 City of Santa Fe stream gage locations (Figure 1 from Lewis and Borchert 2009a)

In all three TMDL reaches, the *E. coli* exceedences typically occurred during high flows (i.e., storm flows) or low flows, which is a commonly observed pattern of bacteria contamination. *E. coli* exceedences were also documented in the middle AU through town during mid-level flows. Developing target loads on a seasonal basis (spring/summer) or monthly basis was explored and abandoned because summer "monsoon" months typically contain both the lowest and highest daily flows for the year (see Figure 2.3). Instead, target loads were established based on flow scenarios or conditions. Establishing loads based on representative flow regimes inherently considers the critical flow conditions stemming from seasonal variations, but does not restrict implementation to a particular date range. Therefore, due to the observed pattern of *E. coli* exceedences, critical stream flows were determined for low and high flow hydrologic scenarios for all AUs, with the addition of a

mid-range flow scenario for the middle AU. A unique, representative loading capacity for each critical *E. coli* flow scenario in the Santa Fe River allows the TMDL to reflect changes in dominant watershed processes that may occur under different flow regimes.

Each of the AUs discussed in this document presented unique challenges for critical flow determination. Sections 2.2.1 – 2.2.3 provide additional detail on the determination of the critical flow values used for target loading calculations.

2.2.1 Santa Fe River (Cienega Creek to the Santa Fe WWTP)

This AU is effluent-dominated. Perennial flow throughout this reach is created by the City of Santa Fe Paseo Real WWTP discharge. The city of Santa Fe documents daily mean discharge as part of their Discharge Monitoring Report (DMR) permit requirements. Daily mean discharge varies seasonally because of water reuse for primarily municipal irrigation purposes in spring, early fall, and summer (Figure 2.2). Localized watershed storms also have the potential to contribute flow between the confluence with Cienega Creek and the WWTP discharge channel, depending on the intensity and duration of the storm event. There can be upstream flow immediately above the WWTP outfall during significant storm events or significant reservoir releases (see cover photo), but this is the exception rather than the rule.

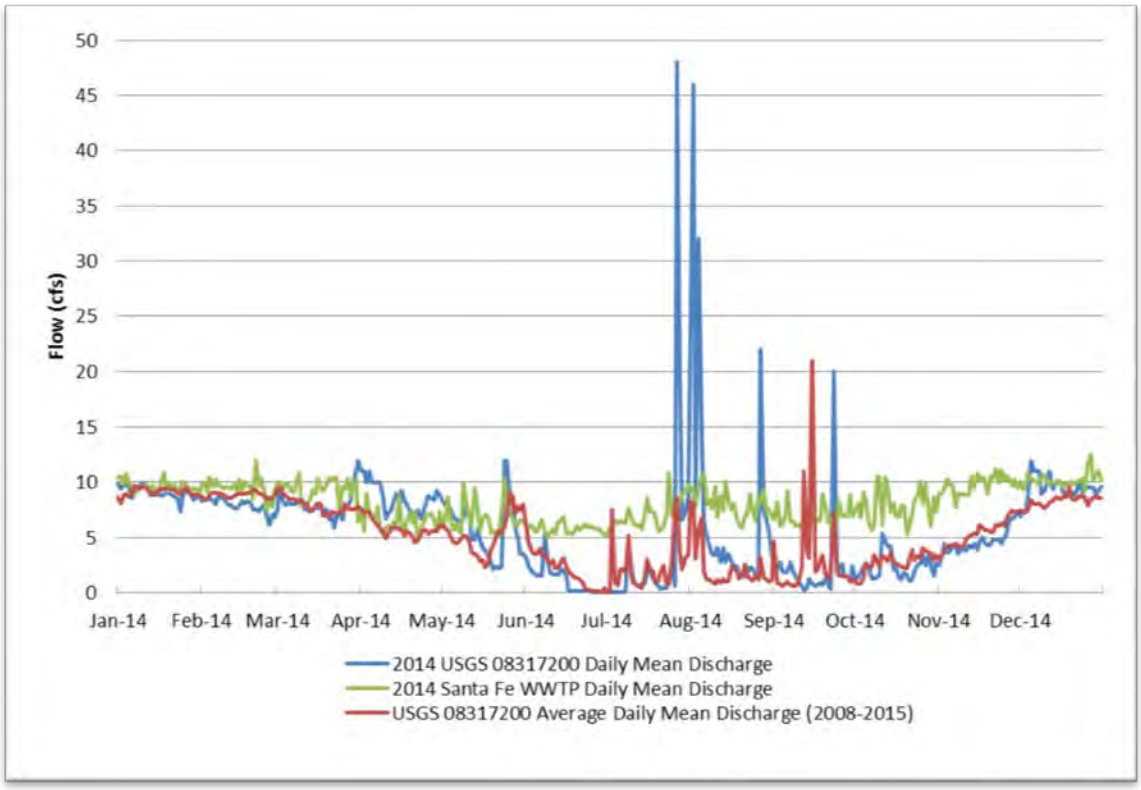

Figure 2.2 USGS 08317200 gage vs. Santa Fe WWTP, daily mean discharge data

The recorded Santa Fe River above Cochiti Lake, NM gage (USGS 08317200) flow is somewhat representative of the effluent-dominated nature of this AU during certain flow regimes and times of the year, yet diverges during lower flows. The Santa Fe WWTP daily mean discharge is more representative of the stream flow in this AU during the low flow hydrologic scenario because water diversions downstream of this AU significantly reduce flow during the growing season before reaching the USGS gage. However, the USGS gage record captures the magnitude of potential storm flows in this watershed and is therefore more representative of the stream flow in this AU during the high flow scenario. Accordingly, the "Low Flow" critical flow scenario was calculated to be the 5th percentile of the average daily DMR flow (2008-present to reflect current conditions), while the "High Flow" scenario was calculated as the area-weighted 95th percentile of the average daily flow at the USGS gage above Cochiti (1972-2016) in order to better characterize potential storm flow conditions from the contributing watershed. Area-weighting was done as described below according to Thomas et al. (1997) and Table 2.1, using 0.45 as the exponent because the Santa Fe River watershed straddles both the Upper Rio Grande Basin and Southeast flood regions described in this area-weighting approach.

$$Q(\text{ungaged}) = Q(u) = Q(g) \times (Au/Ag)^{0.45}$$

Where:

Q(g) = flow statistic at the gaged site (cfs)

Au = drainage area at the ungaged site (mi^2)

Ag = drainage area at the gaged site (mi^2)

Q(u) = area weighted estimated flow statistic at the ungaged site (cfs)

Contributing watershed drainage areas were used for area-weighting flow are contained in Table 2.1.

Table 2.1 Watershed drainage areas and outlet elevations

Location	Elevation (ft)	Drainage Area (mi^2)[(a)]
Santa Fe River above Cochiti Lake (USGS 8317200)	5510	230
Santa Fe River at Cienega Creek	5824	114
Santa Fe River at WWTP outfall channel	6261	50.7
Santa Fe River at Ricardo Road gage (city of Santa Fe)	6782	42.3
Santa Fe River above Saint Francis gage (city of Santa Fe)	6918	34.1
Santa Fe River at Guadalupe Street	6968	33.8

NOTES: [(a)] Determined using USGS Stream Stats website (USGS 2016)

2.2.2 Santa Fe River (Santa Fe WWTP to Guadalupe Street)

The amount of stream flow in this mid-town reach is driven by planned releases from Nichols Reservoir and storm flows. The city of Santa Fe operated a stream gage at Ricardo Road from 2000-2010. These data provide the best record of potential storm flows through this AU, and document the flashiness of this mid-town stream reach (Figure 2.3). Accordingly, the High Flow was calculated as the area-weighted 95th percentile of the average daily flow at the Ricardo Road gage (2000-2010) in order to characterize potential storm flow conditions in the contributing watershed. This High Flow value is congruent with the stream and storm flow analyses performed by the city which states an average peak flow of roughly 10 cfs (Lewis and Borchert 2009a, 2009b). All area-weighting was done as described in Thomas et al. (1997) and Table 2.1, using 0.45 as the exponent.

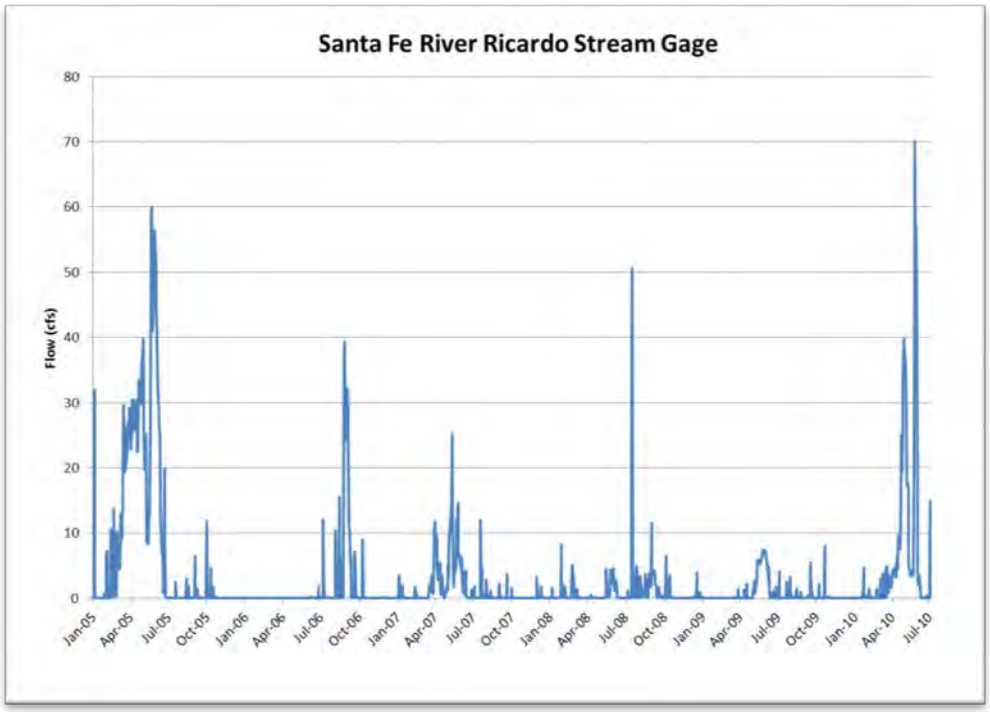

Figure 2.3 City of Santa Fe Ricardo Road gage, 2005-20010

As documented by the Ricardo Road gage, field observation, and the presence of two municipal reservoirs holding back potential flow from the upper watershed, there is zero flow in some portion of this non-perennial mid-town reach for a large part of the year. Consequently, the 5th percentile of average daily flow recorded at the Ricardo Road gage is zero. Using a low flow value of zero is not a valid input into a target loading equation because the resultant TMDL would be zero. This combined with the fact that the low flow data from this gage's period of record (2000-2010) is not reflective of low- and mid- flow conditions post Living River Ordinance reservoir releases necessitates a different approach to determining the low- and mid-range critical flow values for this non-perennial, mid-town reach.

The use of Waltermeyer (2002) or other watershed-based models to determine low flow conditions in this reach was explored and abandoned because reservoir releases control low flow conditions in this reach as opposed to watershed processes and basin characteristics. The yearly release hydrograph determines the low- and mid- flow conditions in this AU at any given time. Although the Living River Ordinance allows the city to put up to 1,000 acre-feet of water back into the Santa Fe River each year, the actual target release hydrograph for each year depends on available and predicted inflow above the municipal reservoirs, required acequia deliveries, special community events (e.g., fishing derby, riparian re-vegetation efforts, etc.), and infrastructure projects (e.g., 2013 dam repair). The proposed hydrograph generally includes a spring pulse, summer pulse, summer flow, and a low-flow trickle (see Figure 2.4 for an example target hydrograph).

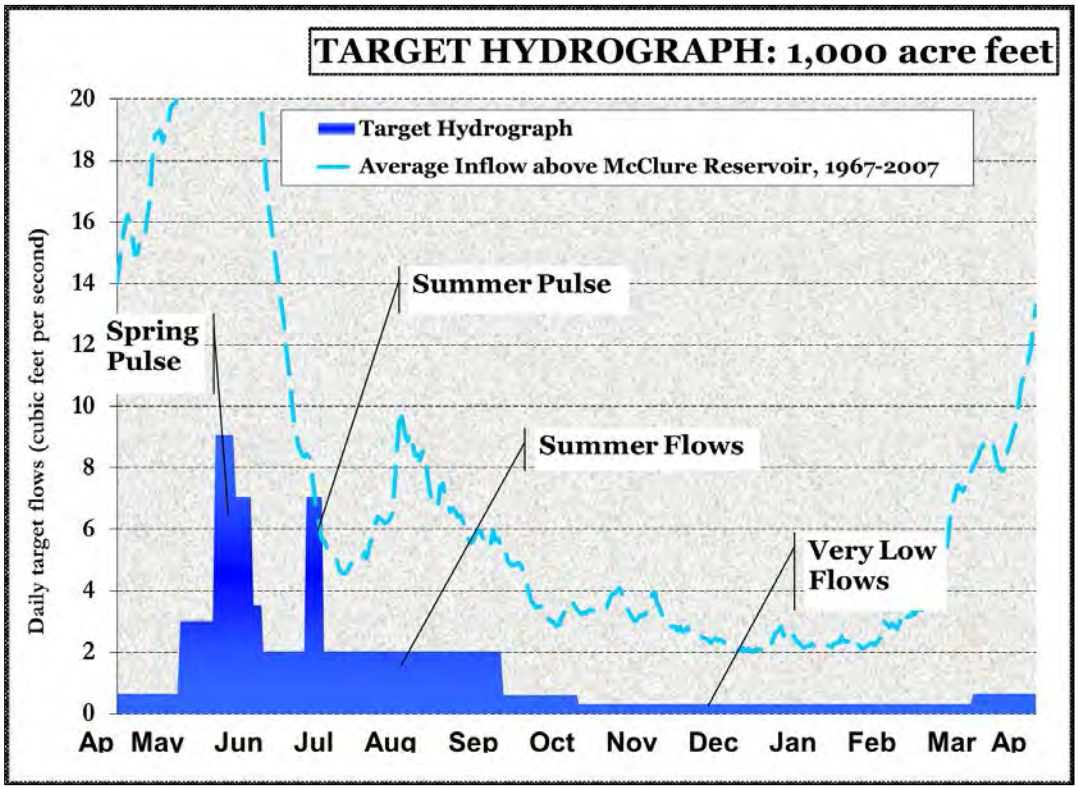

Figure 2.4 Example of Living River Ordinance target allocations (provided by city of Santa Fe)

In order for there to be stream flow throughout this entire non-perennial AU during a non-significant storm event, there needs to be an adequate spring pulse, summer pulse, or other significant planned release below Nichols Reservoir. There is inadequate gaging and no other available documentation to pin point exactly where a particular release flow will make it to during any given reservoir release, making it challenging to determine critical low flow and mid-range flows for this AU. The best source of data available to make these determinations is limited SWQB flow observations at the time of *E. coli* collection and the gage record from the Below Nichols Reservoir gage (2012 – 2016 to represent post Living River Ordinance and match the *E. coli* monitoring period). An estimated low flow value of 1.0 cfs was selected to represent the "Low Flow" critical condition in this AU. This value is

congruent with the average actual late summer low flow release scenarios that have been implemented since the Living River Ordinance went into effect, and is consistent with SWQB flow observations and Below Nichols gage records taking seepage losses into consideration. The "Mid-Range" critical flow was estimated at 5.8 cfs, which is the mid-point between the low and high flow values. This flow value is congruent with SWQB measurements and Below Nichols gage records at the time of *E. coli* exceedences.

2.2.3 Santa Fe River (Guadalupe Street to Nichols Reservoir)

The amount of low flow condition in this AU is heavily dependent upon the amount of flow either seeping or being released from Nichols Reservoir, shallow groundwater influences, as well as acequia diversions. Although approximately 0.5 miles downstream of the AU, the Above St. Francis gage data provide the best record of potential high flows through this AU. The area-weighted 95th percentile of the average daily flow was calculated using the available Above St. Francis gage (2006-2009) in order to represent the "High Flow" condition in this AU. This high flow value is congruent with the stream and storm flow analyses performed by the city which state an average storm inflow rate of 5 cfs (Lewis and Borchert 2009a, 200b). All area-weighting was done as described in Thomas et al. (1997) and Table 2.1, using 0.45 as the exponent.

The low flow data from the Above St. Francis gage is not reflective of post Living River ordinance reservoir releases because data are only available from 2006-2009. This necessitates a different approach to determining the low flow value for this uptown reach. The use of Waltermeyer (2002) or other watershed-based models to determine low flow conditions in this reach was explored and abandoned because reservoir releases control low flow conditions in this reach as opposed to watershed processes and basin characteristics. Accordingly, a value of 0.6 cfs was selected to represent the Low Flow critical condition in this AU based on the average recorded release flow when exceedences occured and SWQB flow observations. This value is congruent with the average actual late summer low flow release scenarios that have been implemented since the Living River Ordinance went into effect.

In summary, several available USGS and city of Santa Fe gage data sources along with SWQB flow observations were collated and explored to determine critical flow values in the Santa Fe River (Table 2.2). Table 2.3 provides a summary of the critical flow scenarios for each AU.

Table 2.2 Flow records used to determine critical flow values

Source	Name	Date Range
USGS 8317200	Santa Fe at Cochiti	4/1/1972 – 9/30/1999, 10/1/2004 - 9/6/2016[(a)]
City of Santa Fe	City of Santa Fe Paseo Real WWTP DMR data	1/1/2008 – 8/31/2016
City of Santa Fe	Ricardo Road Gage	1/1/2000 -7/5/2010[(a)]
City of Santa Fe	Above St. Francis Bridge Gage	10/1/2006 – 12/20/2009[(a)]
City of Santa Fe	Below Nichols Gage	4/1/2012 – 9/13/2016

NOTES: [(a)] Period of record

It is important to remember that the TMDL itself is a value calculated at a defined critical flow condition as part of a planning process designed to achieve water quality standards. Table 2.3 contains estimated critical flow values that are meant to simply represent various flow condition scenarios. Since flows vary at any given day throughout the year in these AUs, the actual target loading capacity on a specific day will vary based on the in-stream flow on that particular day. Therefore, management of the load to improve stream water quality should be the crucial goal to be attained.

Table 2.3 Summary of critical stream flow scenarios and values by AU

Assessment Unit	**Low Flow Condition**	**Mid-Range Flow Condition**	**High Flow Condition**
Santa Fe River (Cienega Creek to Santa Fe WWTP)	3.4 cfs 2.2 mgd	-- [(a)]	18.2 cfs 11.8 mgd
Santa Fe River (Santa Fe WWTP to Guadalupe St)	1.0 cfs 0.6 mgd	5.8 cfs 3.8 mgd	10.6 cfs 6.8 mgd
Santa Fe River (Guadalupe St to Nichols Rsvr)	0.6 cfs 0.4 mgd	-- [(a)]	5.8 cfs 3.8 mgd

NOTES: million gallons per day (mgd) x 1.547 = cubic feet per second (cfs)
[(a)]Critical flow values were not determined because E. coli exceedences were not observed during this flow condition

2.3 Target Loading Capacity

Target loading capacities for *E. coli* are calculated based on the applicable water quality criteria, critical flow, and a conversion factor with the following equation:

$$Target\ Loading\ Capacity\ = Criterion\ \ x\ \ Critical\ Flow\ \ x\ \ Conversion\ Factor$$

$$=\ C\ in\ \frac{cfu}{100mL}\ x\ Q\ in\ 1{,}000{,}000\frac{gallons}{day}\ x\ [1000\frac{mL}{L}x\ \frac{L}{0.264\ gallons}]\ = cfu/day$$

$$TMDL =\ C\ \left(\frac{cfu}{100mL}\right)\ x\ \ Q\ (mgd)\ \ x\ \ \ 3.79\ x\ 10^{7}\ \ =\ \ cfu/day$$

where: C = water quality criterion for bacteria in cfu/100mL
Q = the critical stream flow in million gallons per day (mgd)

The loading capacity, which sets the target load on any given day, is therefore determined by the flow at a particular time of interest and the numerical criterion for *E.coli*. It is easier, however, to communicate information with a set of fixed targets. Accordingly, representative Low Flow, Mid-Range Flow, and High Flow values were determined in the previous sections to quantify the loading capacities for each flow scenario, which allows the TMDL to reflect changes in dominant watershed

processes that may occur, and pollutant sources that are be more prominent under different flow regimes. The target loads (i.e., TMDLs) predicted to attain current water quality standards in each AU at representative flow conditions were calculated using the above equation and are presented in Tables 2.4 through 2.6.

Table 2.4 Target loading capacity for Santa Fe River (Cienega Creek to the Santa Fe WWTP)

Assessment Unit	**Low Flow Condition**	**High Flow Condition**
E. coli geometric mean criterion (cfu/100mL) [(a)]	126	126
Critical Flow (mgd) [(b)]	15.2	24.8
Conversion Factor	3.79×10^7	3.79×10^7
Target Load Capacity (cfu/day)	7.3×10^{10}	1.2×10^{11}

NOTES: million gallons per day (mgd) x 1.547 = cubic feet per second (cfs)
[(a)] Per 20.6.4.900(D) NMAC
[(b)] Total critical flow = critical stream flow (from Table 2.3) + Santa Fe WWTP design flow (13 mgd)

Table 2.5 Target loading capacity for Santa Fe River (Santa Fe WWTP to Guadalupe Street)

Assessment Unit	**Low Flow Condition**	**Mid-Range Flow Condition**	**High Flow Condition**
E. coli geometric mean criterion (cfu/100mL) [(a)]	126	126	126
Critical Flow (mgd) [(b)]	0.6	3.8	6.8
Conversion Factor	3.79×10^7	3.79×10^7	3.79×10^7
Target Load Capacity (cfu/day)	2.9×10^9	1.8×10^{10}	3.3×10^{10}

NOTES: million gallons per day (mgd) x 1.547 = cubic feet per second (cfs)
[(a)] Per 20.6.4.900(D) NMAC
[(b)] Critical stream flow (from Table 2.3)

Table 2.6 Target loading capacity for Santa Fe River (Guadalupe Street to Nichols Reservoir)

Assessment Unit	**Low Flow Condition**	**High Flow Condition**
E. coli geometric mean criterion (cfu/100mL) [(a)]	126	126
Critical Flow (mgd) [(b)]	0.4	3.8
Conversion Factor	3.79×10^7	3.79×10^7
Target Load Capacity (cfu/day)	1.9×10^9	1.8×10^{10}

NOTES: million gallons per day (mgd) x 1.547 = cubic feet per second (cfs)
[(a)] Per 20.6.4.900(D) NMAC
[(b)] Critical stream flow (from Table 2.3)

2.4 Waste Load Allocations

There is currently one individual National Pollutant Discharge Elimination System (NPDES) permit (NM0022292) and a Municipal Separate Storm Sewer Systems (MS4s) permit in the *E. coli* impaired Santa Fe River AUs and contributing watersheds that has the potential to contribute *E. coli*. Therefore, they must be given waste load allocations (WLAs) in the TMDL.

The city of Santa Fe Paseo Real WWTP began operating in 1984 and discharges into the lower AU. The design capacity for the City of Santa Fe Paseo Real WWTP is 13 mgd, although the WWTP currently discharges significantly less that this amount (see Figure 2.2) due in part to slower than projected growth, an aggressive water conservation plan, and waste water diversion for re-use during the growing season. Information from the Master Plan for the City of Santa Fe Wastewater Treatment Facility (Santa Fe 2016) was used to determine existing wastewater flow statistics. According to the plan, the annual average daily flow for the WWTP is 5.5 mgd based on a review of the most recent influent data. Projected maximum daily, and weekly and monthly average daily flows were calculated by applying the peaking factors (i.e., the ratio between various averaging periods) developed for each time period. Table 2.7 provides a summary of existing wastewater flow statistics determined from influent flow data evaluation and peaking factors (for additional information, see Santa Fe 2016). These flow determinations were used to estimate the daily flow value for calculation of the WLA because it is more representative of the current potential discharge than an analysis of the actual reported discharge (i.e., effluent) data, especially during the growing season, because the DMR-reported data do not take into account effluent flow diverted for re-use/irrigation. The city of Santa Fe is not required to divert flow for re-use/irrigation, so the total current potential discharge must be accounted for in case they stop diverting for re-use/irrigation. This is best done using the influent data.

Table 2.7 Existing wastewater flows based on WWTP influent flow data (Santa Fe 2016)

Parameter	**Flow (mgd)**
Annual Average Daily Flow	5.5
Maximum Daily Flow	6.5
Maximum Weekly Average Daily Flow	6.2
Maximum Monthly Average Daily Flow	6.0

The entire WWTP design capacity must be accounted for in the TMDL even though the plant is currently operating well below this capacity. The maximum daily average flow from Table 2.7 was used to calculate the "WLA current" condition in the TMDL. Accordingly, the design flow (13.0 mgd) less the current (6.5 mgd) flow was used to determine potential additional future flow (6.5 mgd) used to calculate the "WLA future" value. The *E. coli* WLA for NPDES permit NM0022292 was calculated by multiplying the applicable water quality criterion (monthly geometric mean, 126 cfu/100mL) by the critical flow (max daily flow, 6.5 mgd) and a conversion factor (3.79×10^7) to obtain WLAs of 3.1×10^{10} cfu/day for both the "WLA Current" and "WLA Future" scenarios. The total WLA for this permitted facility is therefore 6.2×10^{10} cfu/day.

MS4s are defined as a conveyance or system of conveyances owned by a state, city, town, or other public entity that discharges to waters of the United States and is designed or used for collecting or conveying storm water. Because this is a storm water permit, sMS4 permit and associated sMS4 WLAs are only applicable during storm (i.e., high) flow. Regulated conveyance systems include roads with drains, municipal streets, catch basins, curbs, gutters, storm drains, piping, channels, ditches, tunnels and conduits. It does not include combined sewer overflows and publicly-owned treatment works. The federal Clean Water Act requires storm water discharges from certain types of urbanized areas to be permitted under the NPDES program. In 1990, Phase I of these requirements became effective, and municipalities with a population served by a MS4 of 100,000, or more, were regulated. Under Phase I federal storm water regulations, regulated MS4 entities were required to obtain individual permits. In 1999, Phase II became effective, and any entity responsible for an MS4 conveyance, regardless of population size, could potentially be regulated. To date, this designation has typically applied to areas that have been identified by the Bureau of the Census as an "urbanized area" (UA) but with populations less than 100,000 (USEPA 2005).

MS4 conveyances within urbanized areas have one of the greatest potentials for polluted storm water runoff. The Federal Register Final Rule explains the reason as:

> *"…urbanization alters the natural infiltration capacity of the land and generates...pollutants...causing an increase in storm water runoff volumes and pollutant loadings."*

MS4s can be significant sources of *E. coli* because they transport urban runoff that can be affected by pet waste, illicit sewer connections, and failing septic systems.

On September 29, 2006, USEPA Region 6 issued general permits for discharges from regulated "small" MS4s (sMS4s) in New Mexico and on Indian Country lands in New Mexico and Oklahoma. This permit became effective on July 1, 2007, and the renewed permit is expected to be approved in January 2017.[4]

The Phase II sMS4 permit (NMR040000) reads:

> *"This permit may authorize stormwater discharges to waters of the United States from small MS4s within New Mexico provided the MS4… is located fully or partially within an urbanized area in New Mexico as determined by the 2000 and 2010 Decennial Census."*

There are three permittees identified in the Santa Fe urbanized area: the city of Santa Fe, Santa Fe County, and the New Mexico Department of Transportation (NMDOT) District 5. Stormwater covered by the sMS4 has the potential to impact all of the AUs discussed in this document. The sMS4 WLA for each AU has been determined based on the percent of jurisdictional (urban) area within the respective contributing watershed area. The percent and total jurisdictional area, per area *E. coli*

[4] https://www3.epa.gov/region6/water/npdes/sw/sms4/index.htm

loadings, and resultant sMS4 waste load allocations for each AU are presented in Table 2.8. For more information regarding the jurisdictional allocation of sMS4 loads and per area *E. coli* loading values, see Appendix B.

Table 2.8 sMS4 waste load allocations and per area *E. coli* loading

Assessment Unit	**Jurisdictional area (% of contributing watershed area)**	**Jurisdictional area (mi^2)**	**Per area *E. coli* loading (cfu/day per mi^2) [(a)]**	**sMS4 Waste Load Allocation (cfu/day)**
Santa Fe River (Cienega Creek to Santa Fe WWTP)	35	22.0	7.3×10^8	1.6×10^{10}
Santa Fe River (Santa Fe WWTP to Guadalupe St)	74	12.5	1.8×10^9	2.2×10^{10}
Santa Fe River (Guadalupe St to Nichols Rsvr)	15	5.0	4.8×10^8	2.4×10^9

NOTES: [(a)] See Table B.2 in Appendix B.

If at some time in the future there is a change to the Santa Fe jurisdictional urbanized area, revised sMS4 allocations in this TMDL document can be calculated using the applicable per area *E. coli* loading value in Table 2.8 as follows:

$$\text{sMS4 WLA (cfu/day)} = (\text{cfu/day per } mi^2) \times (\text{jurisdictional area in } mi^2)$$

The load allocation would also be adjusted according depending on changes to the urbanized area jurisdiction. (see Section 2.6). This adjustment maintains the overall TMDL via a consistent per area watershed loading and transfers load between the LA and sMS4 WLA. As this change would be consistent with the overall goals of this TMDL, it would not require a formal revision in order to be implemented within an NPDES stormwater permit.

Additionally, excess bacteria concentrations may be a component of some storm water discharges covered under general NPDES permits. For example, stormwater discharges from construction activities are transient because they occur mainly during the construction itself, and then only during storm events. Coverage under the NPDES Construction General Permit (CGP) for construction sites greater than one acre requires preparation of a Storm Water Pollution Prevention Plan (SWPPP) that includes identification and control of all pollutants associated with the construction activities to minimize impacts to water quality. The current CGP also includes state-specific requirements to implement site-specific interim and permanent stabilization, managerial, and structural solids, erosion, and sediment control Best Management Practices (BMPs), and/or other controls. BMPs are designed to prevent to the maximum extent practicable an increase in sediment load to the water body or an increase in a sediment-related parameter, such as total suspended solids, turbidity, siltation, stream bottom deposits, etc. BMPs also include measures to reduce flow velocity during and after construction compared to pre-construction conditions to assure that waste load allocations and/or applicable water quality standards, including the antidegradation policy, are met. Compliance

with a SWPPP that meets the requirements of the CGP is not likely to cause significant degradation of water quality and, therefore, is generally assumed to be consistent with this TMDL.

Stormwater discharges from active industrial facilities are generally covered under the current NPDES Multi-Sector General Permit (MSGP). This permit also requires preparation of an SWPPP, which includes specific requirements to limit (or eliminate) pollutant loading associated with the industrial activities in order to minimize impacts to water quality. Compliance with a SWPPP that meets the requirements of the MSGP is not likely to cause significant degradation of water quality and, therefore, is generally assumed to be consistent with this TMDL.

It is not possible to calculate individual WLAs for facilities covered by these general permits at this time using the available tools. For example, discharges from CGP permits are typically transitory and enforcement is complex as permittees are temporary. Loads that are in compliance with general permits are therefore currently included as part of the load allocation. While these sources are not given individual allocations, they are addressed through other means, including BMPs, stormwater pollution prevention plans, and other requirements. Table 2.9 provides a summary of all *E. coli* WLAs for the Santa Fe River.

Table 2.9 Waste load allocations (WLAs) for *E. coli* in the Santa Fe River

Assessment Unit	**NPDES Permit**	**Design Capacity Flow (mgd)**	***E. coli* criterion (cfu/100mL)** [(b)]	**Conversion Factor**	**Waste Load Allocation (cfu/day)**
Santa Fe River (Cienega Creek to Santa Fe WWTP)	**NM0022292** City of Santa Fe Paseo Real WWTP Exp: 8/31/2021	13.0 [6.5 current+ 6.5 future]	126	3.79×10^7	3.1×10^{10} current + 3.1×10^{10} Future [(c)]
	NMR04000 sMS4[(a)]	N/A	126	3.79×10^7	1.6×10^{10}
Santa Fe River (Santa Fe WWTP to Guadalupe St)	**NMR04000** sMS4[(a)]	N/A	126	3.79×10^7	2.2×10^{10}
Santa Fe River (Guadalupe St to Nichols Rsvr)	**NMR04000** sMS4[(a)]	N/A	126	3.79×10^7	2.4×10^9

Note: [(a)] *From Table 2.8. sMS4 allocations are only applicable during the "High Flow" (i.e., storm water) condition*

[(b)] *Based on applicable geometric monthly mean criterion.*

[(c)] *Total WLA for this permitted facility is 6.2×10^{10} cfu/day.*

2.5 Margin of Safety (MOS)

TMDLs should reflect a MOS based on the uncertainty or variability in the data and the point source and NPS load estimates. For these bacteria TMDLs, the MOS was developed using a combination of conservative assumptions and inputs and explicit recognition of potential errors in flow calculations. Therefore, the MOS is the sum of the following assumptions:

- *Conservative Assumptions (Implicit):*
  - *E. coli* bacteria are able to survive in the freshwater environment (Wcisło and Chróst 2000); and
  - Basing the target load capacity on the geometric mean criterion rather than the higher-concentration single sample criterion.

- *Explicit recognition of potential errors:*
  - There is inherent error in all flow measurements and observations; a conservative MOS for this element in gaged streams is 10%.

2.6 Load Allocations

The load allocation (LA) accounts for the non-point sources (NPS) of pollution in the respective watersheds. Nonpoint sources include all other categories not classified as point sources (i.e., WLAs). In areas such as Santa Fe, nonpoint sources can include leaking or faulty septic systems, pet waste, storm water runoff (originating from outside of the sMS4 jurisdictional area), and other sources. In rural areas, nonpoint sources commonly include runoff from cropland, pastures and animal feeding operations, as well as inputs from streambank erosion, leaking or failing septic systems, and wildlife. The extensive data collection and analyses necessary to determine background *E. coli* loads for the Santa Fe River were beyond the resources available for this study. It is therefore assumed that a portion of the LA is made up of natural background loads. Additional studies using techniques such as microbial source tracking in the watershed would provide insight into specific sources of excessive *E. coli*.

In order to calculate the LA, the WLAs and MOS were subtracted from the target capacity (i.e., TMDL) using the below equation:

$$TMDL = \sum WLA + \sum LA + MOS$$

$$Therefore,$$
$$\sum LA = TMDL - \sum WLA - MOS$$

In these TMDLs, the MOS is estimated to be 10% of the target load. Resultant TMDL calculations, including the LA, are presented in Tables 2.10 - 2.12.

2.7 Total Maximum Daily Loads (TMDLs) for *E. Coli* in the Santa Fe River

Results of the TMDL calculations are presented in Tables 2.10 - 2.12. TMDL values are equivalent to the target load capacities in Tables 2.4 - 2.6.

Table 2.10 TMDLs for Santa Fe River (Cienega Creek to the Santa Fe WWTP)

	Low Flow Condition (cfu/day)	**High Flow Condition (cfu/day)**
Wasteload Allocation (WLA)		
Santa Fe WWTP (NM0022292) Current	3.1×10^{10}	3.1×10^{10}
Santa Fe WWTP (NM0022292) Future	3.1×10^{10}	3.1×10^{10}
Santa Fe sMS4 (NMR04000)	-- [(a)]	1.6×10^{10}
Load Allocation (LA)	3.7×10^{9}	3.0×10^{10}
Margin of Safety (MOS 10%)	7.3×10^{9}	1.2×10^{10}
***E. coli* TMDL (cfu/day)**	**7.3×10^{10}**	**1.2×10^{11}**

Note: [(a)] sMS4 allocations are not applicable during "Low Flow" conditions

Table 2.11 TMDLs for Santa Fe River (Santa Fe WWTP to Guadalupe Street)

	Low Flow Condition (cfu/day)	**Mid-Range Flow Condition (cfu/day)**	**High Flow Condition (cfu/day)**
Wasteload Allocation (WLA)			
Santa Fe sMS4 (NMR04000)	-- [(a)]	-- [(a)]	2.2×10^{10}
Load Allocation (LA)	2.6×10^{9}	1.6×10^{10}	7.7×10^{9}
Margin of Safety (MOS 10%)	2.9×10^{8}	1.8×10^{9}	3.3×10^{9}
***E. coli* TMDL (cfu/day)**	**2.9×10^{9}**	**1.8×10^{10}**	**3.3×10^{10}**

Note: [(a)] sMS4 allocations are not applicable during Low Flow" or "Mid-Range" conditions

Table 2.12 TMDLs for Santa Fe River (Guadalupe Street to Nichols Reservoir)

	Low Flow Condition (cfu/day)	**High Flow Condition (cfu/day)**
Wasteload Allocation (WLA)		
Santa Fe sMS4 (NMR04000)	-- [(a)]	2.4×10^{9}
Load Allocation (LA)	1.7×10^{9}	1.4×10^{10}
Margin of Safety (MOS 10%)	1.9×10^{8}	1.8×10^{9}
***E. coli* TMDL (cfu/day)**	**1.9×10^{9}**	**1.8×10^{10}**

Note: [(a)] sMS4 allocations are not applicable during "Low Flow" conditions

2.8 Consideration of Seasonal Variation

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs take into consideration seasonal variation in watershed conditions and pollutant loading. Data used in the calculation of these TMDLs were collected during the spring, summer, and fall of 2012-2016 in order to ensure coverage of any potential seasonal variation in the system. Bacteria exceedences occurred primarily during high and low flows in all AUs. Exceedences were also documented during mid-range flows in the middle AU through town. Accordingly, seasonal variation is accounted for in this TMDL through the use of Low, Mid-Range, and High flow scenarios. Establishing loads based on representative flow regimes inherently considers seasonal variations and critical conditions attributed to flow conditions while not restricting implementation to a particular date range. Higher flows may flush more nonpoint source runoff containing bacteria. It is also possible that higher concentrations are observed under a low flow condition when there is insufficient dilution; a reduction in flow may result in an increased effective concentration of *E. coli*.

2.9 Identification and Description of Pollutant Sources

SWQB fieldwork typically includes an assessment of the probable sources of impairment (Appendix C). Probable Source Sheets are filled out by SWQB staff during watershed surveys and watershed restoration activities. The list of "Probable Sources" is not intended to single out any single land owner or particular land management activity and generally includes several sources per pollutant. Table 2.13 displays present probable pollutant sources that have the possibility to contribute to increased *E. coli* levels in each AU as determined by field reconnaissance and knowledge of watershed activities. This draft probable source list is reviewed and modified, as necessary, with watershed group/stakeholder input during the TMDL public meeting and comment period. Probable non-point sources of *E. coli* impairments are further evaluated and refined through SWQB Watershed Protection Section activities such as the Watershed-Based Plan (WBP) process and subsequent watershed restoration design process. Point sources are identified and regulated through the NPDES program.

Table 2.13 Probable sources of *E. coli* in the Santa Fe River

TMDL Watershed	Probable Pollutant Sources
Santa Fe River (Cienega Creek to Santa Fe WWTP)	Agriculture, Flow Alteration, Municipal Point Source Discharges, On-Site Treatment Systems (Septic), Urban Runoff/Storm Sewers, Wastes from Pets, Waterfowl, Wildlife other than Waterfowl
Santa Fe River (Santa Fe WWTP to Guadalupe Street)	Flow Alteration, Drought-Related Impacts, Inappropriate Waste Disposal, Irrigation Return Flow, On-Site Treatment Systems (Septic), Urban Runoff/Storm Sewers, Wastes from Pets, Wildlife other than Waterfowl
Santa Fe River (Guadalupe Street to Nichols Reservoir)	Flow Alteration, Dams/Diversion, Drought-Related Impacts, Inappropriate Waste Disposal, On-Site Treatment Systems (Septic), Urban Runoff/Storm Sewers, Wastes from Pets, Wildlife other than Waterfowl

Determining the specific reasons for high levels of *E. coli* within any water body is challenging. There are many potential sources and the bacteria counts are inherently variable. Specific sources of each impaired waterbody should be further evaluated during follow-up implementation activities. While it is beyond the scope of this TMDL to perform a quantitative, site-specific determination of the exact sources of high *E. coli* at each station in a watershed, it is reasonable to expect that general patterns and trends can be used to provide some perspective on the most significant sources. *E. coli* sources typically associated with high flow and moist conditions include failing onsite wastewater systems, urban storm water, runoff from agricultural/livestock grazing areas, and bacterial re-suspension from the streambed particularly during storm events. *E. coli* sources typically associated with low flow conditions include a number of homes on failing or illicitly connected septic systems that could provide a constant source. As discussed in the Wastewater Treatment Facility Master Plan, the Presumptive City Limits provides the overall extent of the service area for the WWTP. It is known that not all residents residing within this region are connected to the sanitary sewer system, and the actual population connected to the sanitary sewer system is likely somewhere between the population for the City and Presumptive City Limits according to the WWTP master plan (Santa Fe 2016). Elevated *E. coli* levels at low flow could also result from inadequate disinfection at wastewater treatment plants or animals with direct access to streams. Waste for pets is also a common source of *E. coli* contamination in urban areas, and many municipalities have implemented successful “Scoop the Poop” programs to inform the community on the water quality consequences of not picking up after their domestic animals.

Specific sources of *E. coli* to each impaired waterbody should be further evaluated during follow-up implementation activities. One method of characterizing sources of bacteria is a Bacterial, or Microbial, Source Tracking (BST) study. The extensive data collection and analyses necessary to determine bacterial sources to this level were beyond the resources available for this study. While sufficient data currently exist to support development of *E. coli* TMDLs to address the stream standards exceedences, the BST dataset would likely prove useful in the future to better identify and then target control efforts towards these specific sources of *E. coli* impacting the stream.

2.10 Future Growth

Population estimates and projected growth by county are available from the New Mexico Bureau of Business and Economic Research (NMBBER 2012). The average annual growth rate was 1.1% from 2000-2010, and slowed to 0.63% from 2010-2014. The 2010-2030 projected growth rate for Santa Fe County is a low 0.9% compared to an overall rate of 10.67% for New Mexico (Rhatigan 2015). This ~1% growth value is also noted in the city's WWTP master plan (Santa Fe 2016).

The city has more than enough existing WWTP design capacity to handle the projected population growth. Estimates of future growth in Santa Fe County are not anticipated to lead to a significant increase in bacteria in this watershed that cannot be controlled with BMPs, especially related to storm water management. It is important that BMPs continue to be developed and utilized in the watershed, including public information campaigns regarding the need to better control diffuse NPS pollution such as waste from pets, as well as adherence to SWPPP requirements related to construction and industrial activities covered under the general permit. As stated in Section 2.4, if at some time in the future there is a change to the jurisdictional area of a stormwater permittee, the allocation between the WLA and LA in this TMDL can be adjusted per Table 2.8. This adjustment maintains the overall TMDL and a consistent per area watershed loading and just transfers load between the LA and WLA.

3.0 APPLICABLE REGULATIONS AND REASONABLE ASSURANCES

New Mexico's Water Quality Act (Act) authorizes the New Mexico Water Quality Control Commission (WQCC) to "promulgate and publish regulation to prevent or abate water pollution in the state" and to require permits. The Act authorizes a constituent agency to take enforcement action against any person who violates a water quality standard. Several statutory provisions on nuisance law could also be applied to NPS water pollution. The Water Quality Act also states in §74-6-12(a):

> *The Water Quality Act (this article) does not grant to the commission or to any other entity the power to take away or modify the property rights in water, nor is it the intention of the Water Quality Act to take away or modify such rights.*

In addition, the State of New Mexico Surface Water Quality Standards (see Subsection C of 20.6.4.6 NMAC) (NMAC 2012) states:

> *Pursuant to Subsection A of Section 74-6-12 NMSA 1978, this part does not grant to the water quality control commission or to any other entity the power to take away or modify property rights in water.*

New Mexico policies are in accordance with the federal Clean Water Act §101(g):

> *It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this Act. It is the further policy of Congress that nothing in this Act shall be construed to supersede or abrogate rights to quantities of water which have been established by any State. Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.*

New Mexico's CWA §319 Program has been developed in a coordinated manner with the State's 303(d) process. All 319 watersheds that are targeted in the annual RFP process coincide with the State's biennial impaired waters list as approved by USEPA. The State has given a high priority for funding, assessment, and restoration activities to these watersheds.

As a constituent agency, NMED has the authority under Chapter 74, Article 6-10 NMSA 1978 to issue a compliance order or commence civil action in district court for appropriate relief if NMED determines that actions of a "person" (as defined in the Act) have resulted in a violation of a water quality standard including a violation caused by a NPS. The NMED NPS water quality management program has historically strived for and will continue to promote voluntary compliance to NPS water pollution concerns by utilizing a voluntary, cooperative approach. The State provides technical support and grant monies for implementation of BMPs and other NPS prevention mechanisms through §319 of the CWA. Since portions of this TMDL will be implemented through NPS control mechanisms, the New Mexico Watershed Protection Program will target efforts to this and other watersheds with TMDLs.

In order to obtain reasonable assurances for implementation in watersheds with multiple landowners, including federal, state, and private land, NMED has established Memoranda of Understanding (MOUs) with various federal agencies, in particular the U.S. Forest Service (USFS) and the Bureau of Land Management (BLM). MOUs have also been developed with other state agencies, such as the New Mexico Department of Transportation. These MOUs provide for coordination and consistency in dealing with NPS issues.

The time required to attain standards for all reaches is estimated to be approximately 10-20 years. This estimate is based on a five-year time frame implementing several watershed projects that may not be starting immediately or may be in response to earlier projects. Stakeholders in this process will include SWQB, and other parties identified in the WBP. The cooperation of watershed stakeholders will be pivotal in the implementation of these TMDLs as well.

On October 27, 2016, USEPA announced a package of tools to help communities plan long-term strategies for managing stormwater pollution. Specifically, USEPA released a step-by-step guide to help communities develop long-term stormwater plans, a web-based toolkit for the planning process, and technical assistance for five communities to develop plans as national models. Santa Fe is fortunate to be one of the five communities selected to receive $150,000 each in technical assistance to develop a long-term stormwater management plan utilizing the initial draft guide. The five selected communities will also be the beta testers for EPA's web-based toolkit, which will be refined and released more broadly in 2017. Find the toolkit at: www.epa.gov/water-research/green-infrastructure-modeling-toolkit.

4.0 PUBLIC PARTICIATION

Public participation was solicited in development of this TMDL. The draft Santa Fe River *E. coli* TMDL was first made available for a 30-day comment period beginning January 4, 2017, ending on February 3, 2017. The draft document notice of availability was extensively advertised via email distribution lists, webpage postings, and press releases to area newspapers. A public meeting was held on January 11, 2017, at the Oliver La Farge Library in Santa Fe from 5-7 pm; eleven stakeholders attended. An additional informational meeting was requested and provided for the MS4 permittees. Four sets of comments were received during the public comment period. A response to comments was prepared as Appendix D. The TMDL was approved by the WQCC on April 11, 2017 and EPA Region 6 on May 3, 2017.

Once the TMDL is approved by the WQCC, the next step for public participation will be participation in development of WBPs and watershed protection projects, including those that may be funded by CWA Section 319(h) grants managed by SWQB.

5.0 REFERENCES

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APPENDIX A: SANTA FE RIVER *E. COLI* AND FLOW DATA (2012-2016)

Santa Fe River (Guadalupe St to Nichols Rsvr)				
Sample Date/Time	***Station Name and ID***	***E. coli Concentration (cfu/100mL)***	***FLOW (cfs or qualitative rating)***	***FLOW COMMENT(S)***
2012-06-04 11:15:00.0	Santa Fe River below Cerro Gordo RD - 30SantaF052.4	14.5	1.7	During 3 cfs reservoir release.
2012-07-18 14:30:00.0	Santa Fe River below Cerro Gordo RD - 30SantaF052.4	119.8	0.5	Reservoir release of 1 cfs. Very light rain.
2013-05-07 14:40:00.0	Santa Fe River below Cerro Gordo RD - 30SantaF052.4	167	moderate	During 2013 spring release. Acequi immediately downstream was full.
2013-05-07 15:40:00.0	Santa Fe River ~75m u/s of Sandoval St - 30SantaF050.5	178.9	moderate	During spring reservoir release.
2013-05-14 13:45:00.0	Santa Fe River ~75m u/s of Sandoval St - 30SantaF050.5	88.2	moderate	
2013-09-17 12:40:00.0	Santa Fe River ~75m u/s of Sandoval St - 30SantaF050.5	387.3	moderate	Post series of September 2013 large storm events.
2013-10-08 14:40:00.0	Santa Fe River ~75m u/s of Sandoval St - 30SantaF050.5	66.3	moderate	During the October 2013 extended dam repair release.
2013-10-08 15:50:00.0	Santa Fe River below Cerro Gordo RD - 30SantaF052.4	15.6	9.53	During the October 2013 extended dam repair release.
2014-03-27 08:30:00.0	Santa Fe River ~75m u/s of Sandoval St - 30SantaF050.5	6.3	7.76	
2014-04-22 14:00:00.0	Santa Fe River below Cerro Gordo RD - 30SantaF052.4	1	9.23	
2014-04-22 14:15:00.0	Santa Fe River ~75m u/s of Sandoval St - 30SantaF050.5	1	9.92	
2014-05-27 10:15:00.0	Santa Fe River below Cerro Gordo RD - 30SantaF052.4	61.3	moderate	
2014-05-29 09:15:00.0	Santa Fe River ~75m u/s of Sandoval St - 30SantaF050.5	98.7	3.4	
2014-06-25 08:40:00.0	Santa Fe River ~75m u/s of Sandoval St - 30SantaF050.5	69.7	2.5	
2014-07-23 08:50:00.0	Santa Fe River ~75m u/s of Sandoval St - 30SantaF050.5	727	1 (estimated)	
2014-07-23 11:35:00.0	Santa Fe River below Cerro Gordo RD - 30SantaF052.4	344.8	moderate	
2014-08-20 11:30:00.0	Santa Fe River ~75m u/s of Sandoval St - 30SantaF050.5	101.9	low flow	
2014-10-01 10:30:00.0	Santa Fe River ~75m u/s of Sandoval St - 30SantaF050.5	579.4	0.4 (estimated)	
2014-10-15 11:20:00.0	Santa Fe River ~75m u/s of Sandoval St - 30SantaF050.5	547.5	0.2 (estimated)	
2014-11-14 13:00:00.0	Santa Fe River below Cerro Gordo RD - 30SantaF052.4	3	0.3 (estimated)	
2016-06-02 11:00:00.0	Santa Fe River 5 meters u/s of Guadalupe St - 30SantaF050.3	32.37	moderate	During 2016 city of Santa Fe spring pulse release.
2016-06-13 10:00:00.0	Santa Fe River 5 meters u/s of Guadalupe St - 30SantaF050.3	135.4	moderate	
2016-06-29 09:45:00.0	Santa Fe River 5 meters u/s of Guadalupe St - 30SantaF050.3	307.59	moderate	
2016-08-05 16:30:00.0	Santa Fe River 5 meters u/s of Guadalupe St - 30SantaF050.3	>2419.6	flood flow	

Santa Fe River (Santa Fe WWTP to Guadalupe St)				
Sample Date/Time	***Station Name and ID***	***E. coli Concentration (cfu/100mL)***	***FLOW (cfs or qualitative rating)***	***FLOW COMMENT(S)***
2012-06-04 08:45:00.0	Santa Fe River below Frenchies Field - 30SantaF044.5	410.6	0.7	
2012-06-04 09:45:00.0	Santa Fe River blw St Francis Dr. - 30SantaF047.9	28.8	0.9	During 3 cfs reservoir release.
2013-05-13 14:30:00.0	Santa Fe River below Frenchies Field - 30SantaF044.5	22.5	moderate	During spring reservoir release.
2013-09-17 13:20:00.0	Santa Fe River below Frenchies Field - 30SantaF044.5	727	moderate	
2013-09-17 13:35:00.0	Santa Fe River at CRd 68A (San Isidro Crossing) - 30SantaF041.2	613.1	moderate	
2013-09-17 14:00:00.0	Santa Fe River above Hwy 599 - 30SantaF035.9	770.1	moderate	
2013-10-08 11:15:00.0	Santa Fe River immed u/s of WWTP effluent channel - 30SantaF032.9	435.2	moderate	During October 2013 extended dam repair release.
2013-10-08 12:20:00.0	Santa Fe River above Hwy 599 - 30SantaF035.9	139.6	moderate	
2013-10-08 12:50:00.0	Santa Fe River at CRd 68A (San Isidro Crossing) - 30SantaF041.2	101.9	moderate	
2013-10-08 13:05:00.0	Santa Fe River below Frenchies Field - 30SantaF044.5	461.1	5.3	
2014-03-27 09:10:00.0	Santa Fe River above Hwy 599 - 30SantaF035.9	59.1	moderate	
2014-04-22 18:30:00.0	Santa Fe River above Hwy 599 - 30SantaF035.9	290.9	moderate	
2014-05-28 18:30:00.0	Santa Fe River above Hwy 599 - 30SantaF035.9	33.1	3.6	
2014-06-25 14:15:00.0	Santa Fe River below Frenchies Field - 30SantaF044.5	18.3	0.6	
2016-06-02 12:50:00.0	Santa Fe River at CRd 68A (San Isidro Crossing) - 30SantaF041.2	83.61	moderate	
2016-06-13 09:00:00.0	Santa Fe River at CRd 68A (San Isidro Crossing) - 30SantaF041.2	435.17	1 (estimated)	
2016-06-29 09:00:00.0	Santa Fe River at CRd 68A (San Isidro Crossing) - 30SantaF041.2	325.54	moderate	
2016-08-05 17:10:00.0	Santa Fe River at CRd 68A (San Isidro Crossing) - 30SantaF041.2	>2419.6	flood flow	

Santa Fe River (Cienega Creek to Santa Fe WWTP)				
Sample Date/Time	***Station Name and ID***	***E. coli Concentration (cfu/100mL)***	***FLOW (cfs or qualitative rating)***	***FLOW COMMENT(S)***
2013-10-08 10:00:00.0	Santa Fe River above CRd 56 d/s of river preserve - 30SantaF028.4	123.6	moderate	During October 2013 extended dam repair release.
2014-03-27 11:00:00.0	Santa Fe River above CRd 56 d/s of river preserve - 30SantaF028.4	56.5	moderate	
2014-04-22 17:45:00.0	Santa Fe River above CRd 56 d/s of river preserve - 30SantaF028.4	139.6	8.3	Extrapolated from WWTP discharge (2.8 cfs) and flow at 599 (5.7 cfs)
2014-05-28 16:40:00.0	Santa Fe River above CRd 56 d/s of river preserve - 30SantaF028.4	88	6.8	Extrapolated from WWTP (3.17 cfs) discharge and flow at 599 (3.60 cfs)
2014-06-25 12:15:00.0	Santa Fe River above CRd 56 d/s of river preserve - 30SantaF028.4	686.7	1.6	
2014-07-23 15:25:00.0	Santa Fe River above CRd 56 d/s of river preserve - 30SantaF028.4	501.2	1.4	
2014-08-20 13:55:00.0	Santa Fe River above CRd 56 d/s of river preserve - 30SantaF028.4	>2419.6	1.4	
2014-10-01 12:10:00.0	Santa Fe River above CRd 56 d/s of river preserve - 30SantaF028.4	130.8	3.5	Extrapolated from WWTP discharge (no flow at 599)
2014-10-15 12:35:00.0	Santa Fe River above CRd 56 d/s of river preserve - 30SantaF028.4	195.6	3.2	Extrapolated from WWTP discharge (no flow at 599)

NOTES: Highlighted cells indicate an exceedence of the applicable water quality criterion.

APPENDIX B: JURISDICTIONAL AREA APPROACH

EPA released a memo entitled "Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs" in November 2002 clarifying EPA regulations regarding Waste Load Allocations (WLA) and Municipal Separate Storm Sewer Systems (MS4s) in TMDLs; a revision to the memo was released in 2010. In November 2008, EPA released the draft TMDLs to Stormwater Handbook to provide guidance to states as to how to include WLAs for MS4s in TMDLs. The handbook provides a number of options for states to consider when developing TMDLs that include MS4 allocations. One of the waterbody-based approaches to TMDL development includes the jurisdictional area approach:

> *"Jurisdictional area: loading capacity is allocated to permitted stormwater sources (and other land-based sources) on the basis of the portion of the drainage area included within their physical boundary. Without knowing the specific area draining to a stormwater conveyance system, the stormwater source area can be represented by the jurisdictional or operational area of the source (e.g., urbanized area for an MS4). For example, if the loading capacity is 100 lbs/day and the urbanized area of an MS4 represents 30 percent of the area draining to the assessment location, the MS4 WLA is specified as 30 lbs/day."*

The excerpts from the TMDLs to Stormwater Handbook provide the framework from which SWQB developed the WLA for the Phase II sMS4 permittees for each impaired Assessment Unit. The following explanation provides additional detail on these jurisdictional area calculations.

Determination of Contributing Watershed and Urbanized Areas

For the purposes of the sMS4 WLA determinations, the total watershed area for each AU was first determined via USGS StreamStats v.3, using above the most downstream point of the assessment unit (AU) as the watershed pour point. The contributing watershed area for each AU was then determined by subtracting out upstream AU(s) contributing watershed. The urbanized area per each AU was determined using the unionized 2000 and 2010 Census data GIS coverages, and is the urbanized area within each resultant contributing watershed area. Both watershed and urbanized area determinations for the three AUs are presented in Table D1 and Figure B.1.

Phase II Permit Jurisdictional Area Approach

The sMS4 permittees eligible for coverage under the general Phase II MS4 permit are discussed in Section 4.4.1. The Phase II sMS4 permit (NMR04000) reads:

> *"This permit may authorize stormwater discharges to waters of the United States from small MS4s within New Mexico provided the MS4… is located fully or partially within an urbanized area in New Mexico as determined by the 2000 and 2010 Decennial Census."*

Percent Jurisdictional area per AU is determined as follows:

> Urbanized Area / Contributing Watershed Area = % Jurisdictional Area

The total Urbanized Areas (UA) within the Santa Fe River watershed upstream of Cienega Creek was determined from GIS coverages to be 35.0 mi^2. Approximately 4.0 mi^2 of the urbanized area were assigned to the Santa Fe River (Guadalupe St to Nichols Rsvr) AU, 11.3 mi^2 were assigned to Santa Fe River (Santa Fe WWTP to Guadalupe St) AU, and the remainder (19.7 mi^2) were assigned to the Santa Fe River (Cienega Creek to Santa Fe WWTP) AU. See Figure B.1.

Therefore, for example, the Santa Fe River (Cienega Creek to Santa Fe WWTP) is calculated as follows:

22.0 mi^2 / 63.3 mi^2 = 35%

The rounded percent jurisdictional areas per AU are presented in Table B.1.

Table B.1 Jurisdictional Areas

	Santa Fe River (Cienega Creek to Santa Fe WWTP)	**Santa Fe River (Santa Fe WWTP to Guadalupe St)**	**Santa Fe River (Guadalupe St to Nichols Rsvr)**
Urbanized Area*+	22.0 mi^2	12.5 mi^2	5.0 mi^2
Contributing Watershed Area+	63.3 mi^2	16.9 mi^2	33.8 mi^2
Percent Jurisdictional Area (rounded)	35%	74%	15%

NOTES: * *Urbanized Areas within the contributing watershed area were determined using GIS data associated with the unionized 2000 and 2010 Census – 2000 and 2010 TIGER Files*

\+ *Both contributing watershed areas and urbanized areas do not include areas already accounted for in upstream AUs.*

These calculations are summarized in Section 2.4. The Phase II sMS4 WLA values used in the TMDL document were calculated using these rounded percentages.

The remaining percentage was designated for nonpoint sources and natural background as the LA. The WLA values for NMR040000 (Phase II sMS4s) are listed in Table 2.9.

The target loading capacities were calculated as described in Tables 2.4-2.6. From this calculated TMDL value, the Margin of Safety (MOS) and the NPDES permits were subtracted. In order to calculate the Phase II sMS4 permit WLAs, the percentages derived using the jurisdictional area approach were applied to the remaining TMDL quantity (Table 4.6).

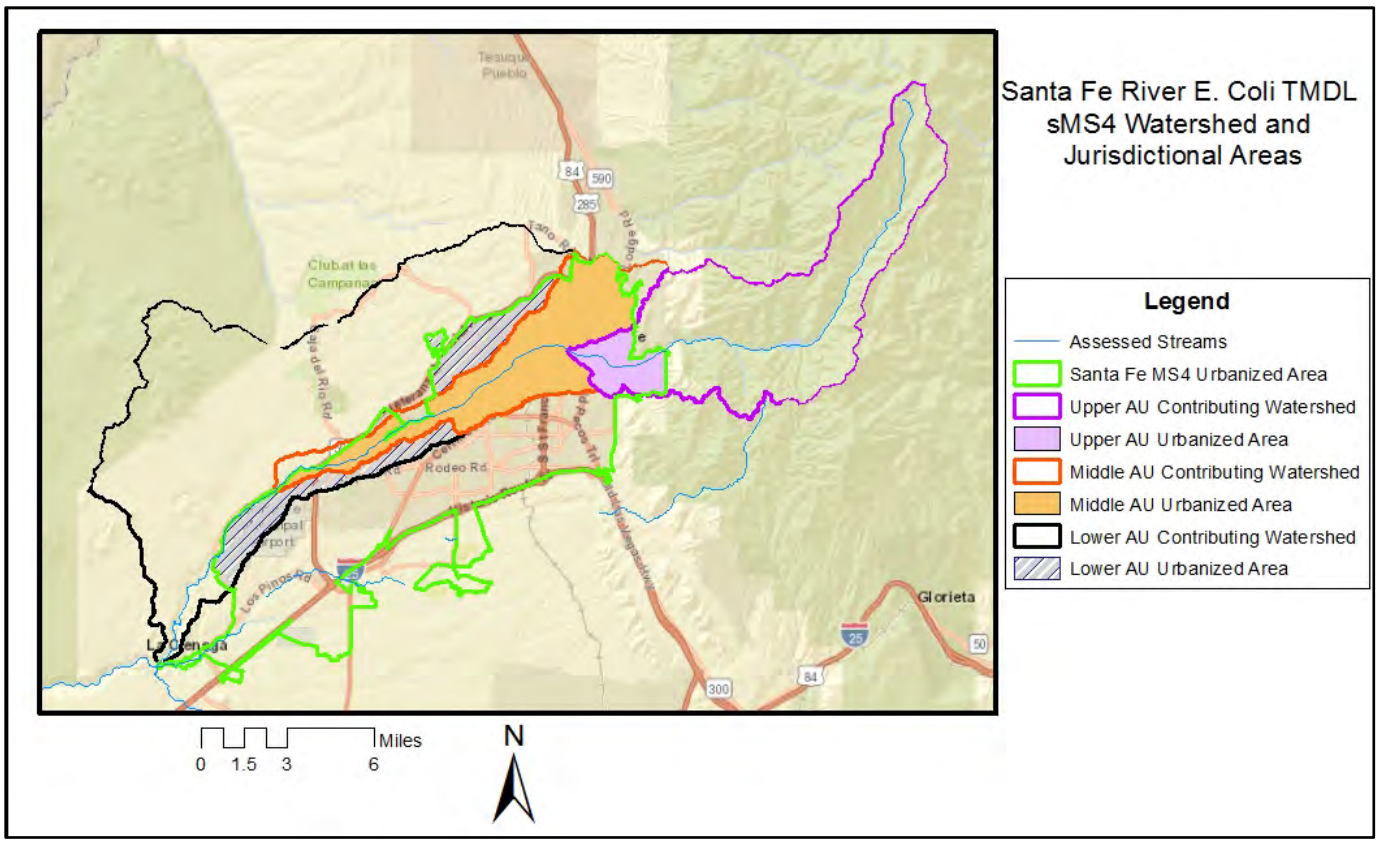

Figure B. 1 Santa Fe River *E. coli* TMDLs Contributing Watershed and Jurisdictional Areas

For example, the *E. coli* High Flow scenario WLA for the Santa Fe River (Cienega Creek to Santa Fe WWTP) AU was calculated as follows:

TMDL –MOS – NPDES NM0022292 WLA = available for LA and sMS4 WLA
$(1.2 \times 10^{11}) - (1.2 \times 10^{10}) - (6.2 \times 10^{10}) = 4.6 \times 10^{10}$ cfu/day

The sMS4 WLAs were assigned as a percentage of the LA.
Phase II sMS4 WLA = 35%, therefore;
NMR04000 WLA = $0.35 \times 4.6 \times 10^{10}$ cfu/day = 1.6×10^{10} cfu/day

The remaining available load is allocated to the LA. The final TMDL allocations are therefore as follows:

TMDL – MOS – NPDES WLA – MS4 WLA = LA
$1.2 \times 10^{11} - 1.2 \times 10^{10} - 6.2 \times 10^{10} - 1.6 \times 10^{10} = 3.0 \times 10^{10}$ cfu/day

If at some time in the future there is a change to the jurisdictional area of a stormwater permittee, the allocation between the WLA and LA presented in the associated TMDL can be adjusted using a per area loading. This adjustment maintains the overall TMDL and a consistent per area watershed

loading and transfers load between the LA and WLA. As this change would be consistent with the overall goals of the TMDL, it would not require a formal revision in order to be implemented within an NPDES stormwater permit.

The loading factor was calculated by dividing the combined existing sMS4 allocation and load allocation by the contributing watershed area. The following equation was used for the calculation:

(sMS4 WLA + LA) / Contributing Area = Loading Factor

The parameter values and resultant loading factors are in Table D.2.

Table B.2 Loading Factors based on Contributing Areas and sMS4 WLA+LA

Assessment Unit	***E. coli* sMS4 WLA + LA (cfu/day)**	**Total Contributing Area (mi^2)**	**Per area *E. coli* loading ($cfu/day/mi^2$)[(a)]**
Santa Fe River (Cienega Creek to Santa Fe WWTP)	4.6×10^{10}	63.3	7.3×10^{8}
Santa Fe River (Santa Fe WWTP to Guadalupe Street)	3.0×10^{10}	16.9	1.8×10^{9}
Santa Fe River (Guadalupe St to Nichols Reservoir)	1.6×10^{10}	33.8	4.8×10^{8}

Notes: [(a)] $cfu/day/mi^2$ = colony forming units per day per square mile

References:

USEPA. 2002. Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs. Washington, D.C. Available online at http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/final-wwtmdl.pdf.

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APPENDIX C: SOURCE DOCUMENTATION SHEET AND SOURCES

"Sources" are defined as activities that may contribute pollutants or stressors to a water body (USEPA 1997). The list of "Probable Sources of Impairment" in the Integrated 303(d)/305(b) List, Total Maximum Daily Load documents (TMDLs), and Watershed-Based Plans (WBPs) is intended to include any and all activities that could be contributing to the identified cause of impairment. Data on Probable Sources is routinely gathered by Monitoring and Assessment Section staff and Watershed Protection Section staff during water quality surveys and watershed restoration projects and is housed in the SWQB's in-house database (SQUID). More specific information on Probable Sources of Impairment is provided in individual watershed planning documents (e.g., TMDLs, WBPs, etc.) as they are prepared to address individual impairments by assessment unit.

USEPA through guidance documents encourages states to include a list of Probable Sources for each listed impairment. According to the 1998 305(b) report guidance, *"…, states must always provide aggregate source category totals…"* in the biennial submittal that fulfills CWA section 305(b)(1)(C) through (E) (USEPA 1997). The list of "Probable Sources" is not intended to single out any particular land owner or single land management activity and has therefore been labeled "Probable" and generally includes several sources for each known impairment.

The approach for identifying "Probable Sources of Impairment" was recently modified by SWQB. Any new impairment listing will be assigned a Probable Source of "Source Unknown." Probable Source Sheets will continue to be filled out during watershed surveys and watershed restoration activities by SWQB staff. Information gathered from the Probable Source Sheets will be used to generate a draft Probable Source list in consequent TMDL planning documents. These draft Probable Source lists will be finalized with watershed group/stakeholder input during the pre-survey public meeting, TMDL public meeting, WBP development, and various public comment periods. The final Probable Source list in the approved TMDL will be used to update the subsequent Integrated List.

Literature Cited:

USEPA. 1997. Guidelines for preparation of the comprehensive state water quality assessments (305(b) reports) and electronic uptakes. EPA-841-B-97-002A. Washington, D.C.

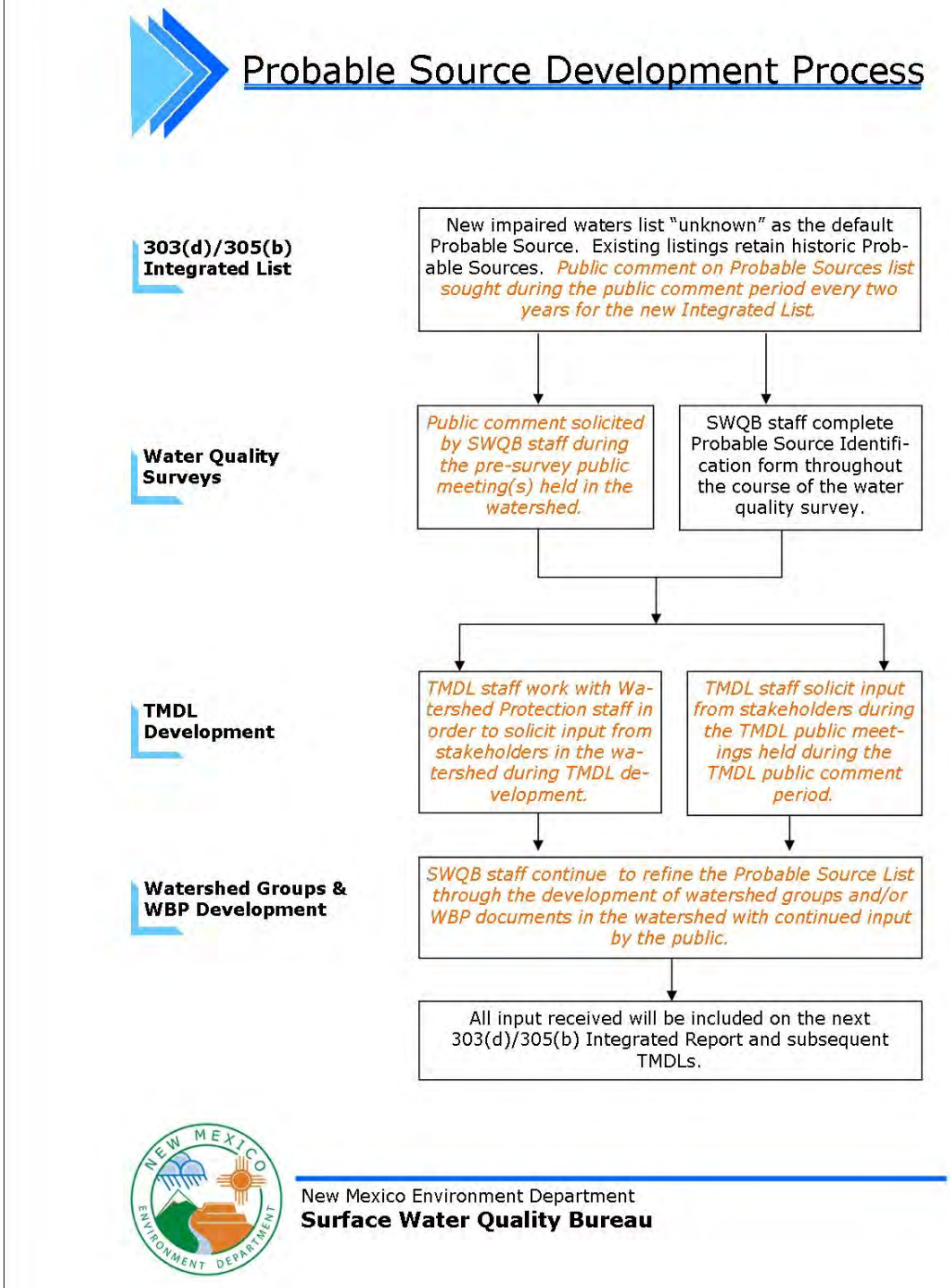

Figure C.1 Probable Source Development Process and Public Participation Flowchart

Help Us Identify Probable Sources of Impairment

Name:
Phone Number (optional):
Email or Mailing Address (optional):
Date:
Waterbody or site description (example - Fish Creek near HWY 34 crossing):

From the list below, please check activities known to exist that you are concerned may be contributing to surface water quality impairment. Please score items you check based on distance to or occurrence on or near the waterbody of concern.

(1 = Low occurrence or not near waterbody)
(3 = Moderate occurrence or within ½ mile of waterbody)
(5 = High occurrence or right next to water body)

✓	ACTIVITY	Score		
☐	Feedlots	1	3	5
☐	Livestock Grazing	1	3	5
☐	Agriculture	1	3	5
☐	Flow Alterations (water withdrawal)	1	3	5
☐	Stream/River Modification(s)	1	3	5
☐	Storm Water Runoff	1	3	5
☐	Drought Related	1	3	5
☐	Landfill(s)	1	3	5
☐	Industry/Wastewater Treatment Plant	1	3	5
☐	Inappropriate Waste Disposal	1	3	5
☐	Improperly maintained Septic Systems	1	3	5
☐	Waste from Pets	1	3	5

✓	ACTIVITY	Score		
☐	Pavement and Other Impervious Surfaces	1	3	5
☐	Roads/Bridges/Culverts	1	3	5
☐	Habitat Modification(s)	1	3	5
☐	Mining/Resource Extraction	1	3	5
☐	Logging/Forestry Operations	1	3	5
☐	Housing or Land Development	1	3	5
☐	Habitat Modification	1	3	5
☐	Waterfowl	1	3	5
☐	Wildlife other than Waterfowl	1	3	5
☐	Recreational Use	1	3	5
☐	Natural Sources	1	3	5
☐	Other: *(please describe)*	1	3	5

Comments/additional information:

Revised 02Aug12

Figure C.2 Probable Source Identification Sheet for the Public

28 Jun 2011
Ver. 5

Probable Source(s) & Site Condition Class Field Form

Station ID:	Station Name/Description:
AU ID:	AU Description:
Field Crew:	Comments:
Date:	Watershed protection staff reviewer: Date of WPS review:

Score the proximity, intensity and/or certainty of occurrence of the following activities in the AU upstream of the site. Consult with the appropriate staff at NMED and other agencies to score "*" cells if needed.

Activity Checklist

Hydromodifications					Silviculture				
Channelization	0	1	3	5	* Logging Ops – Active Harvesting	0	1	3	5
Dams/Diversions	0	1	3	5	* Logging Ops – Legacy	0	1	3	5
Draining/Filling Wetlands	0	1	3	5	* Fire Suppression (Thinning/Chemicals)	0	1	3	5
Dredging	0	1	3	5	Other:	0	1	3	5
Irrigation Return Drains	0	1	3	5	**Rangeland**				
Riprap/Wall/Dike/Jetty Jack -- circle	0	1	3	5	Livestock Grazing or Feeding Operation	0	1	3	5
Flow Alteration (from Water Diversions/Dam Ops – circle)	0	1	3	5	Rangeland Grazing (dispersed)	0	1	3	5
Highway/Road/Bridge Runoff	0	1	3	5	Other:	0	1	3	5
Other:	0	1	3	5	**Roads**				
Habitat Modification					Bridges/Culverts/RR Crossings	0	1	3	5
Active Exotics Removal	0	1	3	5	Low Water Crossing	0	1	3	5
Stream Channel Incision	0	1	3	5	Paved Roads	0	1	3	5
Mass Wasting	0	1	3	5	Gravel or Dirt Roads	0	1	3	5
Active Restoration	0	1	3	5	**Agriculture**				
Other:	0	1	3	5	Crop Production (Cropland or Dry Land)	0	1	3	5
Industrial/ Municipal					Irrigated Crop Production (Irrigation Equip)	0	1	3	5
Storm Water Runoff due to Construction	0	1	3	5	* Permitted CAFOs	0	1	3	5
Landfill	0	1	3	5	* Permitted Aquaculture	0	1	3	5
On-Site Treatment Systems (Septic, etc.)	0	1	3	5	Other:	0	1	3	5
Pavement/Impervious Surfaces	0	1	3	5	**Miscellaneous**				
Inappropriate Waste Disposal	0	1	3	5	Angling Pressure	0	1	3	5
Residences/Buildings	0	1	3	5	Dumping/Garbage/Trash/Litter	0	1	3	5
Site Clearance (Land Development)	0	1	3	5	Exotic Species (describe in comments)	0	1	3	5
Urban Runoff/Storm Sewers	0	1	3	5	Hiking Trails	0	1	3	5
Power Plants	0	1	3	5	Campgrounds (Dispersed/Defined – circle)	0	1	3	5
* Industrial Storm Water Discharge (permitted)	0	1	3	5	Surface Films/Odors	0	1	3	5
* Industrial Point Source Discharge	0	1	3	5	Pesticide Application (Algaecide/Insecticide)	0	1	3	5
* Municipal Point Source Discharge	0	1	3	5	Waste From Pets (high concentration)	0	1	3	5
* RCRA/Superfund Site	0	1	3	5	* Fish Stocking	0	1	3	5
Other:	0	1	3	5	Other:	0	1	3	5
Resource Extraction					**Natural Disturbance or Occurrence**				
* Abandoned Mines (Inactive)/Tailings	0	1	3	5	Waterfowl	0	1	3	5
* Acid Mine Drainage	0	1	3	5	Drought-related Impacts	0	1	3	5
* Active Mines (Placer/Potash/Other – circle)	0	1	3	5	Watershed Runoff Following Forest Fire	0	1	3	5
* Oil/Gas Activities (Permitted/Legacy – circle)	0	1	3	5	Recent Bankfull or Overbank Flows	0	1	3	5
* Active Mine Reclamation	0	1	3	5	Wildlife other than Waterfowl	0	1	3	5
Other:	0	1	3	5	Other Natural Sources (describe in	0	1	3	5

Figure C.3 Probable Source Identification Sheet for SWQB Field Use

APPENDIX D: RESPONSE TO COMMENTS

Revisions in response to additional SWQB staff review

Tables ES1-ES3, 2.4 - 2.6, and 2.10 – 2.12 erroneously stated the E. coli TMDL and Target Loading Capacity units as "cfu/100 mL/day." The units have been corrected to "cfu/day."

Low Water Crossing erroneously included on Table 2.13. It has been removed.

The 2419.6 cfu/100mL monitoring values in Appendix A were clarified to ">2419.6" cfu/100mL.

The New Mexico History Museum withdrew their application for a discharge permit on 3/2/17, (after the public comment period) because they were granted an Industrial User Water Discharge Permit from the City of Santa Fe on 2/17/17. They will now be discharging their sump water into the city's WWTP system. Therefore, the paragraph discussing this potential permit was struck from this TMDL.

Comment Set 1 – Mr. Craig Jolly, Santa Fe, NM

Corrected version received via email 1/10/17:

Dear Ms. Guevara:

Below please find my comments regarding the draft *Santa Fe River E. Coli Total Maximum Daily Loads (TMDL)* proposal.

1. As both a Santa Fe resident and a New Mexico resident, I applaud the NMED SWQB's proposal for E. Coli TMDL management for the Santa Fe River. Santa Fe owes it very origins to the existence of this river, and its transformation over just thirty miles from pristine wilderness mountain springs and snowmelt, to a polluted urban storm water drainage ditch, to a dry stream bed carrying seasonal effluent releases, is a grim testament to the carelessness with which we desert dwellers treat such a precious and vital resource. I appreciate every effort on the part of the SWQB to fulfill the mandates of both the Federal Clean Water Act and our own state requirements and to hold the purity of all our waters, including the Santa Fe River, to the highest possible standards.

SWQB Response: *Thank you for your comment and support of our efforts.*

2. This said, I find a serious omission in the draft in question: namely, a failure to address potential contributing *E. Coli* factors in the stretch of river *above* Nichols Reservoir. I raise this concern in part because of the Santa Fe National Forest's current practice of permitting cattle in allotments adjoining the Santa Fe Municipal Watershed boundary, because of the nonexistence of fencing along this watershed boundary, and because of the documented history these cattle have of trespassing into the Municipal watershed. I refer you here to an investigative article that appeared this last September in the *Santa Fe Reporter* ("Major Beef: Trespassers in the Watershed Prompt Questions About New Mexico's Cattle Culture", 9/7/16) http://www.sfreporter.com/santafe/mobile/articles/articleView/id:12439. Here I quote:

Hike far enough into the trail systems on the eastern border of town, and you run into signs declaring the territory behind them closed to human access. Out of concern for contamination from humans and dogs, and to reduce the risk of wildfire, the municipal watershed has been closed since 1932. Violators face a potential $5,000 fine. Walk that line for a while, and the signs show the effects of having served in someone's target practice, and what's left of a barbed wire fence lies snarled in the dirt.

A hiker can look over into those ponderosa pines and think longingly of the relatively untouched terrain beyond, the steep forest and intermittent tributaries running toward the Santa Fe River, feeding the city's reservoirs. We've agreed to offer that territory up in the name of clean drinking water. But cows don't read, and in most places, no fence bars them from wandering right into the watershed, which they did last summer.

"It wasn't like they were hanging on the ridges; they were down standing in the good green stuff by the river," says Sandy Hurlocker, District Ranger for Santa Fe National Forest's Española District, whose office got the call from city staff. "We're pretty perplexed that cows were coming in there."

They called the cattle's owner, and a few days later, the animals were removed. For the time being.

"They may have wandered back down later in the season," Hurlocker says. "It might have been a couple times."

I can also speak here from personal experience. Last summer I hiked several times along the southern boundary of the Municipal Watershed from Atalaya Mountain to Thompson Peak. The GPS track on the map below shows a stretch of 2.86 miles along this unfenced boundary line all of which showed ample cattle manure on the Watershed side of the boundary line and on the very slopes draining down into the Santa Fe River *above* Nichols Reservoir. The draft report speaks of the effects of monsoon rains on drainage into the River. Cattle manure is, as you well know, a prime candidate as an *E. Coli* contamination source, and it is patently clear that any cattle manure on these slopes during our heavy monsoon rains is necessarily going to be flushing into the river below. Consonant with this possibility is the grab sample reading of 344.8 cfu/100 ml I note from 2014-07-23, taken from below Cerro Gordo Road (page 36 in the draft). While this is not an exceedence per se of the 410 cfu/100 ml threshold, it is perilously close. As the draft notes, it will take a BST to identify precisely the sources of contamination, but circumstantially, a documented upstream slope of cattle manure is a source too significant to ignore in this report or proposal.

Nor is this the only potential source of contamination by cattle manure within the Municipal and Santa Fe River Watershed. Cattle also graze by permit in the area adjoining the Santa Fe Ski Basin and routinely leave their permitted allotments to graze upon the slopes of the ski area itself. Each of the last two summers I have encountered herds of these trespass National Forest cattle midway up the ski slopes, and I have encountered their manure all the way to the ridge line between Tesuque and Deception Peaks. As you know, this ridge lies directly above Santa Fe Lake and the headwaters of the Santa Fe River, both of which, I believe, are ONRW waters. As is the case with the Municipal Watershed's southern boundary line, there is no fencing here. So, once again, these trespass cattle may currently wander freely into the watershed drainage and any

manure along or below this watershed boundary ridge line may wash freely into Santa Fe Lake and the Santa Fe River, as another source of upstream human-sourced *E. Coli* contamination.

After personally encountering manure from trespass cattle while hiking along the lines of each of these unfenced boundary locations last summer, I contacted both Sandy Hurlocker, District Rangers for the SFNF Espanola District, and Steve Romero, District Ranger for the SFNF Peco/Las Vegas District, to express my concerns about possible Municipal Watershed contamination by cattle manure. The essence of the joint response I received, dated 9/21/16 (and the full text of which I would be happy to share with you upon request), is that, in spite of the acknowledged lack of fencing along the watershed boundary line and in spite of the acknowledged, repeated, and documented incidents of extended cattle trespass in these areas with all the manure (and potential *E. Coli*) that attends (which manure is always left in situ after these incidents and never removed), both Districts intend to continue issuing grazing permits for these allotments adjoining the watershed.

SWQB Response: *This TMDL document addresses documented E. coli impairments in the Santa Fe River. Available data for the assessment unit "Nichols Reservoir to headwaters" do not indicate any E. coli impairment (see below table; no values exceeded the applicable single sample water quality criterion of 235 cfu/100 mL). Therefore, TMDLs were not prepared for this assessment unit. Furthermore, it does not appear that trespass cattle are contributing E. coli in amounts significant enough to cause impairment of the Santa Fe River as indicated by the data. Nevertheless, your comments regarding observed cattle in the upper watershed provide valuable information to SWQB, land managers, and stakeholders as we move forward with watershed based plans and strategies to reduce potential sources of E. coli throughout the entire contributing watershed.*

Sample Date/Time	*Station Name and ID*	*E. coli Concentration (cfu/100mL)*
2014-04-22 12:15:00.0	Santa Fe River above McClure Reservoir at gage - 30SantaF061.1	<1
2014-05-28 09:45:00.0	Santa Fe River above McClure Reservoir at gage - 30SantaF061.1	<1
2014-07-23 10:20:00.0	Santa Fe River above McClure Reservoir at gage - 30SantaF061.1	3.1
2014-08-20 10:00:00.0	Santa Fe River above McClure Reservoir at gage - 30SantaF061.1	2
2014-09-24 11:15:00.0	Santa Fe River above McClure Reservoir at gage - 30SantaF061.1	45
2014-11-14 23:14:00.0	Santa Fe River above McClure Reservoir at gage - 30SantaF061.1	1

From the above available data set, it does not appear that potential trespass cattle crossing over the ridge from the ski basin in the into the protected area of the watershed above McClure Reservoir are contributing E. coli in amounts significant enough to cause impairment of to the Santa Fe River.

Regarding your other area of concern, E. coli data collected once yearly from the station immediately upstream of Nichols Reservoir from 2001 to 2004 do not indicate E. coli impairment (results were <1 to 5 cfu/100 mL). We did not collect E. coli data at this station during the 2014 survey because resources only allowed for one sampling station in the AU so the station above McClure Reservoir was selected as the lowest available station on the unregulated reach of the Santa Fe River. If resources allow during our next rotational survey of this watershed, we will sample E. coli at the station above Nichols Reservoir to capture potential contributions from activities such as trespass cattle in the lower section of the watershed between the two reservoirs.

3. A second concern I have pertains to the hiker and ski patrol shelters that Santa Fe Ski Basin has constructed and maintains on this same Municipal Watershed Boundary line between Tesuque and Deception Peaks. To the best of my knowledge neither of these shelters, both of which see full-time use during the season from mid-November through mid-April, provides any proper restroom options. Again, both shelters sit on the watershed boundary line above Santa Fe Lake and the headwaters of the Santa Fe River. Due to frozen ground and deep snow, any human waste accruing outside these shelters (which is inevitable during five months of heavy all-day winter use by the tens of thousands of employees, skiers, and hikers who are on these peaks) cannot be properly buried. Thus, it remains within the snowpack until spring runoff, at which time it necessarily and inevitably washes down into the ONRW Santa Fe Lake and River below, as yet another potential human-caused source of *E. Coli* within the watershed *above* Nichols Reservoir.

SWQB Response: *See data set in above response. Available data for the assessment unit "Nichols Reservoir to headwaters" do not indicate E. coli impairment. Based on available data, it does not appear that alleged improper disposal of human waste near these shelters in the watershed above McClure Reservoir are contributing E. coli in amounts significant enough to cause impairment of the Santa Fe River.*

4. Given the above, I request the following:

(a). First, that this draft be amended and extended to recognize and incorporate the *full* watershed, to include the reaches of the Santa Fe River *above* Nichols and McClure Reservoirs and clear to the headwater area beneath Lake and Deception Peaks. As noted above, there are clear and obvious potential human-derived sources of *E. Coli* situated within *(*trespass cattle) and immediately adjacent to and uphill of (cattle and Santa Fe Ski Basin employees, customers, and visitors) the Santa River upstream of the areas contained within this draft proposal. Not to include these in a proposal to monitor and manage *E. Coli* TMDLs in the same river downstream makes no sense. These are the very same waters, and to arbitrarily select, monitor, and manage only the lower reaches is to grant a carte blanche to the polluters above, of which there are presently potentially at least two categories (grazing permittees of a Federal agency and a business operated under a special use permit issued and overseen by the same Federal agency).

SWQB Response: *The water bodies that SWQB prepares TMDLs for are not arbitrarily selected. Water bodies are divided into Assessment Units (AUs) to characterize segments with different defining attributes (ecoregion, significant tributaries, and hydrologic modification, to name a few). As required by the Clean Water Act, SWQB prepares TMDLs for documented impaired AUs. Impairment is determined via application of our Listing Methodologies (a.k.a. Assessment Protocols) and NM's water quality standards found in 20.6.4 NMAC, using available data that meets QA/QC requirements. As mentioned above, the TMDL is the first step in moving forward with watershed based plans and strategies to reduce potential sources of E. coli throughout the entire contributing watershed.*

(b). Referring to page 30 in the draft proposal, under "3.0 Applicable Regulations and Assurances", I note the following citation from the Clean Water Act §101(g):

Federal agencies shall cooperate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.

On the same page, I also note the following*:*

As a constituent agency, NMED has the authority under Chapter 74, Article 6-10 NMSA 1978 to issue a compliance order or commence civil action in district court for appropriate relief if NMED determines that actions of a "person" (as defined in the Act) have resulted in a violation of a water quality standard including a violation caused by a NPS.

Given this, I request that, along with making the above amendments to the draft proposal, the NMED SWQB pursue an immediate inquiry into these two Federally-permitted potential *E. Coli* contamination sources. I say "immediate" because the Santa Fe Ski Company is even now in the midst of its season, and without proper and readily accessible human waste containment facilities associated with its summit employee (ski patrol and lift attendant) and visitor and hiker shelter facilities, I would contend that they are already in violation of New Mexico law on several counts, and will necessarily contribute through the lack of these human waste containment facilities to *E. Coli* contamination of the ONRW upper Santa Fe River in the coming spring runoff.

I say "immediate" also because the 2017 grazing season is already approaching, and I would contend that the SWQB has sufficient grounds in the above for seeking an injunction against the issuance of further Federal grazing permits for the allotments from which the trespass cattle described above are originating, until such time as proper watershed exclusion fencing is fully in place, given that the upper reaches are ONRWs and that these incursions, with the serious *E. Coli* contamination potential, are occurring within a closed NM Municipal Watershed.

SWQB Response: *As stated in earlier responses, there are no documented violations of the E. coli water quality standard in the Santa Fe River upstream of Nichols Reservoir Assessment Unit. Therefore, the authority under Chapter 74, Article 6-10 NMSA 1978 is not the applicable avenue to address your concerns. Your provided your draft TMDL comments to the respective land management agencies. They are also part of the TMDL record, and will continue to inform land managers and stakeholders as watershed-based planning and restoration strategies develop for the Santa Fe River.*

In the event that I am unable to make next week's public meeting, I'll again hope for an acknowledgement of your receipt of these comments and an eventual follow-up on them. Meanwhile, thank you again for the good work you do, for your consideration of these comments, and your attention to these matters of immediate and ultimate health concern to all Santa Fe River Watershed and all Rio Grande Watershed residents.

Sincerely,
Craig D. Jolly
1674 Camino Cruz Blanca
Santa Fe, NM 87505
505-946-8132
cdouglasjolly@gmail.com

cc:
Maria Garcia (Supervisor, SFNF)
Sandy Hurlocker (Espanola District Ranger)

Steve Romero (Pecos District Ranger)
Andy Otto (Santa Fe Watershed Association)
Francois-Marie Patorni (Santa Fe Watershed Association)
Tom Jervis (Sangre de Cristo Audubon Chapter)
Madeleine Carey (WildEarth Guardians)
Joseph Zupan (Amigos Bravos)
Joe Maestas (Santa Fe District 2 Councilor)

Comment Set 2 – New Mexico Department of Agriculture, Agricultural Programs & Resources Division, Las Cruces, NM

Received via email 1/31/17:

Ms. Guevara,

NMDA's comments regarding the draft "Total Maximum Daily Load" document for the Santa Fe watershed are attached. If you have questions regarding these comments, please let me know.

Best regards,
Katie Kruthaupt
New Mexico Department of Agriculture
Agricultural Programs & Resources Division
kkruthaupt@nmda.nmsu.edu
O: 575-646-2006 C: 575-932-9817

New Mexico Department of Agriculture
Agricultural Programs & Resources Division
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575-646-2642, fax: 575-646- 1540

January 30, 2017

Ms. Lynette Guevara
NMED SWQB
P.O. Box 5469
Santa Fe, NM 87502

RE: Draft Total Maximum Daily Loads for the Santa Fe Watershed

Dear Ms. Guevara:

New Mexico Department of Agriculture (NMDA) submits the following comments regarding the E. coli Draft Total Maximum Daily Loads (Draft TMDL) recently published by New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB) for the Santa Fe River from Cienega Creek to Nichols Reservoir. Our comments are specific to our mission within state government -dedication to the promotion and enhancement of New Mexico's agriculture, natural resources, and quality of life.

Section 2.9 of the Draft TMDL presents information on how the SWQB assesses the probable sources of impairment. Based on the description of the development of the list of probable sources, it appears that SWQB staff diligently work with stakeholders to identify problems. While it is commendable to work with the public to develop these lists, the lists do not appear to be subject to scientific analysis.

The Draft TMDL states that it is beyond the scope of the TMDL to perform a quantitative, site- specific determination of the exact sources of high E. coli at each station in a watershed. According to the U.S. National Library of Medicine, the most comprehensive way of identifying E. coli sources involves collecting samples and comparing their genetics against known specimens of E. coli. Without microbial source tracking, the relative contribution of different potential sources cannot be determined; and the list of probable sources is only a hypothesis. As currently written, there are no safeguards preventing a popular opinion from causing one or several categories being overrepresented. NMDA requests that SWQB provide the specific scientifically valid sources for E. coli in order for the public and end users of the TMDL document to have accurate information.

SWQB Response: *It is not necessary and, as stated in Section 2.9, resources do not allow SWQB to perform microbial source tracking prior to TMDL development. In practice, the completion of an E. coli TMDL can lead to opportunities for subsequent microbial source tracking efforts to better target and address sources of E. coli in the contributing watershed through an approved watershed based plan and application for grant funding. The City of Santa Fe and other partners are already researching funding sources for such studies. Section 2.9 and Appendix C both explain that the Probable Sources list is a starting point to be refined/revised as watershed based plans develop, and do not single out any specific source or land owner.*

NMDA appreciates the opportunity to provide comments on the Draft Total Maximum Daily Loads for the Santa Fe River. Please contact Ms. Kathryn Kruthaupt at (575) 646-2006 or kkruthaupt@nmda.nmsu .edu with any questions or concerns regarding these comments.

Sincerely,
Julie Maitland

JMW/kk/ya

Work Cited

Carson, Andrew C., et. al. "Comparison of Ribotyping and Repetitive Extragenic Palindromic- PCR for Identification of Fecal Escherichia coli from Humans and Animals." U.S. National Library of Medicine. March 2003. Web. 26 January 2017. http://www .ncbi.nlm.nih.gov/pmc/articles/PMC 150071/.

Comment Set 3 – New Mexico Division of Transportation, Drainage Design Bureau, Santa Fe, NM

Received via email 2/2/17:

Attached is a letter with the NMDOT comments on the Public Comment Draft Santa Fe River E. coli Total Maximum Daily Loads (TMDLS) [Cienega Creek to Nichols Reservoir], dated December 28, 2016.

Thank you for your work on this.

Steven Morgenstern, PE
Drainage Design Bureau, NMDOT
Santa Fe, NM 505-827-5330

New Mexico Department of Transportation
General Office NMDOT
1120 Cerrillos Road, Room 218
Santa Fe, NM 87507

February 2, 2017

Lynette Guevara
NMED, Surface Water Quality Bureau
1190 St. Francis Drive
Santa Fe, New Mexico 87502

Dear Ms. Guevara:
The New Mexico Department of Transportation (NMDOT) submits the following written comments on the Public Comment Draft Santa Fe River E. coli Total Maximum Daily Loads (TMDLS) [Cienega Creek to Nichols Reservoir], dated December 28, 2016.
For brevity and convenience, the assessment unit (AU) segments below are referred to by the following shorthand (based on NM Standards Segment number):

Cienega Creek to Santa Fe WWTP = AU113
Santa Fe WWTP to Guadalupe Street = AU136
Guadalupe Street to Nichols Reservoir = AU137

1. Figures 1.4 & 1.5: In the Legend box, incorrectly labels the "Santa Fe sMS4 Urban Area". What is shown is the 2010 Census Bureau Urbanized Area. This is not the sMS4 boundary. Please update the maps to show the MS4 boundary, which is the union of the Census Bureau Urbanized Areas from both 2000 and 2010. (also see comment 9 below)

SWQB Response: *Figures 1.4, 1.5, and B.1; Tables ES-1 – E-3, 2.8 – 2.12 and B.1; and related text passages have been updated using the unionized Census 2000 and 2010 GIS coverage.*

2. Page 12, Section 2.1: The logic presented seems valid overall and I am not disagreeing with the concept. The last two lines (especially the last line, "ensures") may not be statistically accurate. Wouldn't it be possible to meet the geometric mean criterion and still have one or more exceedance of the standard?

SWQB Response: *It would be possible to have one or more exceedences of the single sample criterion and still meet the geometric mean criterion. If all single sample measurements used to calculate the measured geometric mean are below the geometric mean criterion value, the measured geometric mean would be below the geometric mean criterion. The wording was revised to clarify the intent.*

3. Page 17, Figure 2.4: As the graph shows average data over one full year, beginning and ending with April, shouldn't the dashed blue line for Avg. Inflow be the same height at both April callouts? Is this an error in the horizontal scale labeling, or the graph linework? Also, the text labels on the horizontal scale don't line up with the tick marks.

SWQB Response: *The example target hydrograph was replaced with a different example that addresses your concerns.*

4. Section 2.2.3, page 18: The 95% flow rate for AU137 is calculated based on the gage just above St. Francis. Figure 2.1 shows this gage adjacent to St. Francis Drive. It appears that this stream gage is not in AU137. If this gage is the basis of the AU flow rates, then it should be within the reach. The dividing point for the two reaches (AU1136 & AU137) should be changed from Guadalupe St. to St. Francis Dr. This

would make the estimated flow rate more internally consistent and accurate. The approximate distance between St. Francis and Guadalupe Street along the river is about a half mile.

SWQB Response: *Gages do not need to be within a stream reach to provide information on estimated flow conditions in an upstream reach. As stated in the text, SWQB believes this stream gage provides the best available record of potential high flows in this AU. In addition, the gage data were area-weighted accordingly. Had there been available gage data at the AU/WQS break (Guadalupe Street), it would have been used. Clarification was added regarding the gage location. The AU break at Guadalupe Street is dictated by 20.6.4.136 and 20.6.4.137 NMAC, and can therefore only be changed via revisions to these sections in 20.6.4 NMAC.*

5. Section 2.2.3, page 18: The low flow value for AU137 (most upstream segment) is 0.6 cfs. Then, the low flow value for AU136 (middle segment) is 1.0 cfs. During low flow conditions there will be minimal to no additional water added to the Santa Fe River as it flows through town. Given that AU136 is downstream of AU137 and there will be losses due to infiltration, how can the low flow increase downstream of the water source? The low flow value for AU136 should be the same as or less than the low flow value for AU137. Low flow conditions are controlled by releases from Nichols Reservoir. High flow conditions result from stormwater runoff, so this rationale does not apply during high flows and an increase in high flow values in the downstream AUs is then reasonable.

SWQB Response: *Estimating flow in this middle AU was very challenging, especially given the lack of gage data. Estimating potential losses due to infiltration was beyond the resources allotted to this TMDL development. SWQB stands by the estimated low flow value to 1.0 cfs for the reasons stated in Section 2.2.2. As stated at the end of Section 2.0, estimated critical flow values are meant to simply represent various flow condition scenarios.*

6. Table 2.5: Verify the calculation for Target Load Capacity for Low Flow Condition, AU136. (1.0cfs/1.5472)*126cfu*3.79*10^7 = 3.1x10^9, not 2.9x10^9 as shown. This may be the result of a rounding error. 1.0 cfs = 0.646 mgd. If mgd is rounded to 0.6, and then 0.6 is used in the calculation one gets 2.9x10^9. However, the source value for flow is 1.0 cfs, which is the true value that should be carried through the calculation.

SWQB Response: *The rounded value of 0.6 mgd from Table 2.3 was used in the calculation in Table 2.5. Rounding is acceptable, especially given the lack of precision in the estimated flow value. The Target Load Capacity of 2.9 x 10^9 is correct.*

7. Page 22, 4th paragraph, just after italics: While fertilizer, construction, and streambank erosion may contribute to stormwater runoff carrying substances other than pure water, they are not significant sources of E. coli and should be removed from this paragraph.

SWQB Response: *These items were removed from this paragraph.*

8. Page 23, paragraph after italics: The third permittee is actually NMDOT District 5, not the state-wide organization. Please correct the text to indicate this.

SWQB Response: *The text was corrected.*

9. Page 23, Table 2.8, & Appendix B: Per Appendix B, page 39, the WLAs were determined using only the 2010 Census Bureau boundary. However, this does NOT accurately reflect the area of the MS4 boundary. The MS4 boundary is the union of the 2000 and 2010 Census Bureau Urbanized Area boundaries. As such the WLA determinations calculated in Appendix B and presented in this report undercount the appropriate land area. WLA calculations should be performed using the MS4 boundary, not the 2010 Census Bureau UA boundary. The 2010 UA boundary is about 10% smaller than the MS4 boundary based on the union of the 2000 and 2010 UA boundaries. Therefore, the method used in this draft report incorrectly underestimates the WLA by about 10%.

SWQB Response: *Figures 1.4, 1.5, and B.1; Tables ES-1 – E-3, 2.8 – 2.12 and B.1; and related text passages have been updated using the unionized Census 2000 and 2010 GIS coverage.*

10. All Jurisdictional Area calculations and discussions (in Report text body and Appendix B) should refer to the MS4 boundary, not the 2010 UA.

SWQB Response: *Figures 1.4, 1.5, and B.1; Tables ES-1 – E-3, 2.8 – 2.12 and B.1; and related text passages have been updated using the unionized Census 2000 and 2010 GIS coverage.*

11. Page 25, Table 2.9: add clarification that both the WWTP Design Capacity Flow and WLA, current and future, are additive. Total WLA would equal 6.2x10^10. The top paragraph on page 22, right after Table 2.7, might be a good place to more clearly explain this and show the 6.2x10^10 value.

SWQB Response: *The comma in these table fields were changed to "+" to clarify. The text after Table 2.7 was also clarified.*

12. Page 27, Table 2.11: see comment 6, check calculation for Low Flow TMDL.

SWQB Response: *The low flow calculations in Table 2.11 are correct.*

13. All WLA calculations to determine compliance/exceedance are based on knowing the flow rate in the Santa Fe River. As there are no USGS streamflow gauges on the Santa Fe River in the MS4 (as compared to the MRG MS4 which conveniently has USGS stream gauges in their river) how does NMED propose permittees determine river flow rates at the time of sample collection without incurring great expense to install and maintain stream gauges to monitor river flow rates just for this one parameter?

SWQB Response: *This is a permitting and compliance question that is not able to be addressed in the TMDL, but should be communicated to the EPA Region 6 permits section to clarify the language and potential monitoring requirements in the sMS4 permit. The sMS4 permittees should collectively strive to revive at least the existing inactive stream gages in the Santa Fe River in order to document flow conditions at time of sampling and through the year in response to storm events and planned reservoir releases. It is our understanding that the City is already exploring ways to re-activate these gages.*

14. Page 32, Section 4.0: replace double asterisks with actual numbers.

SWQB Response: *The asterisks were placeholders since these two items were not known prior to opening the public comment draft. They have been replaced with actual numbers.*

The NMDOT appreciates the opportunity to comment on this Draft TMDL and looks forward to receiving the final TMDL in the near future.

Sincerely,

Steven Morgenstern, P
Drainage Design Bureau, NMDOT 505-827-5330

cc: Ted Barber, NMDOT
Jerry Schoeppner, Santa Fe County Utilities Division
David Pike, City of Santa Fe Public Works Department
Melissa McDonald, City of Santa Fe Public Works Department
Sarah Holcomb, NMED

Additional comment received via email 2/3/2017:

The New Mexico Department of Transportation (NMDOT) submits the following additional comments on the Public Comment Draft Santa Fe River E. coli Total Maximum Daily Loads (TMDLS) [Cienega Creek to Nichols Reservoir], dated December 28, 2016. These continue the numbering scheme from the letter sent yesterday, February 2, 2017.

15. Page 21, text and Table 2.7: The wording does not match the idea intended. See the attached pdf for suggested alternative wording. As currently written, for example, in Table 2.7 "Maximum Weekly Flow" means that you calculated the total flow volume for 52 one-week periods and the flow value shown is the maximum total flow over one week. This does not agree with the table units of million-gallons/day, and does not appear to be the intent of the row entry. What the intent appears to show is that daily flows were averaged over 52 one-week periods, and the week with the highest average daily flow (maximum weekly average daily flow) had an average daily flow of 6.2 mgd. Please change the wording to more clearly and accurately reflect the intent and method used.

SWQB Response: *The corrections suggested were made to both the text and Table 2.7.*

16. In several places in the report it is stated that if jurisdictional areas of a permittee change, the MS4 WLA can be recalculated accordingly. This implies that while

TMDLs may never go away, they can be amended when needed. The report also states that the WWTP is operating a little below one-half capacity, and therefore using only one-half of its WLA. Based on the very low projected population growth for Santa Fe as stated in the report, the WWTP will continue operating at its current level for the foreseeable future (at least through the 2020 census and resultant jurisdictional area changes). This situation therefore means that there are 3.1x10^10 cfu/day theoretically allocated to the WWTP, but that they are not using. We request that this portion of the WLA be added to the MS4 WLA until such time that the WWTP increases their discharge to the Santa Fe River, at which time the allocation can be returned to the WWTP.

SWQB Response: *The "future" WWTP WLA in the TMDL cannot be added to the MS4 WLA in the TMDL because the entire design capacity for the WWTP must be taken into account when calculating the WLA for the WWTP (40 CFR 144.25). According to the EPA NPDES website on Water Quality Trading (https://www.epa.gov/npdes/water-quality-trading), trading provisions are incorporated into permits by NPDES permitting authorities. In New Mexico, the NPDES permitting authority is EPA Region 6.*

Comment Set 4 – Santa Fe Watershed Association, Santa Fe, NM

Received via email 2/3/17: Lynette:

Thank you for your work on the Public Comment Draft and we have attached our opinions of probable sources. If you have any questions or suggestions, please feel free to call or write.
We look forward to working with you on this in the future,
Thanks again,
Andy Otto
Executive Director
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Santa Fe Watershed Association
1413 Second Street, Suite3
Santa Fe, NM 87505

February 3, 2017

Lynette Guevara
New Mexico Environment Department

RE: Santa Fe River E. coli Total Maximum Daily Loads (TMDLS) dated December 28, 2016

Dear Lynette:

We applaud the Department's work in preparing the above referenced report and urge the continued monitoring and implementation of the plan to remove the impairment to the Santa Fe River from Nichols Reservoir to Cienega Creek junction.

SWQB Response: *Thank you for your comment and support of our efforts.*

We would like to insure that what we feel as probable sources of this impairment be identified. From our experience with the Adopt The River program, we believe that the main source for E. coli through the urban reaches of the Santa Fe River are the homeless people who have no other alternative for their waste than to leave it in the riparian zone of the Santa Fe River. This would include the reaches of the River between the junction of Aztec Springs watershed to the Paseo Real Water Reclamation Facility.

SWQB Response: *Based on observations by your organization and city personnel during implementation of the Adopt the River program, Inappropriate Waste Disposal has been added to the middle stream reach in Tables E-2 and 2.13. SWQB encourages land managers and stakeholders in the Santa Fe River watershed to develop programs to address this probable source of pollution in the impaired reaches of the Santa Fe River.*

Additionally, we believe that both domestic pets and wildlife waste may be a potentially large source of E. coli in the entire reach of the Santa Fe River from Nichols Reservoir to Cienega Creek.

SWQB Response: *Thank you for your observation. Domestic pets and Wildlife are included in Tables E-2 and 2.13.*

Both of these are not necessarily drought related but rather an on-going issue caused by a lack of proper waste disposal facilities.

Thank you for your time on this,
Andy Otto, Executive Director